PHASE 3 REMEDIAL INVESTIGATION REPORT
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SCHAEFER ROAD AREA
DEARBORN, MICHIGAN

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TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION AND BACKGROUND

This Phase 3 Remedial Investigation Report for the Schaefer Road Area (Site), in Dearborn, Michigan, was prepared by Conestoga-Rovers & Associates (CRA) on behalf of the Ford Motor Company (Ford) and Severstal North America (SNA), for submittal to the Michigan Department of Environmental Quality (MDEQ) Corrective Action Unit of the Waste and Hazardous Materials Division in Lansing, Michigan. This report summarizes the investigation activities conducted at and adjacent to the Site between October 2006 and March 2007 and was prepared pursuant to Part 201 of Michigan's Natural Resources and Environmental Protection Act of 1994 (P.A. 451) as amended, to characterize on-Site and off-Site soil and groundwater quality.

This report presents results from the investigation activities presented in the June 23, 2006 CRA document entitled *Phase 3 Remedial Investigation Work Plan, Schaefer Road Area* (CRA, 2006a). This report also includes results from investigation activities presented in the April 26, 2006 CRA document entitled *Interim Response Activity Work Plan, Schaefer Road Area* (CRA, 2006b). The Phase 3 Work Plan and the Interim Response Activity (IRA) Work Plan were approved by the MDEQ on August 21, 2006 after receiving CRA's Response to MDEQ Comments, dated March 6 and May 26, 2006 (CRA 2006c and CRA 2006d, respectively).

The remainder of the Report describes the methodologies used to complete the Phase 3 and IRA investigations and summarizes the analytical results from the soil, groundwater, surface water and dense non-aqueous phase liquid (DNAPL) and light non-aqueous phase liquid (LNAPL) samples collected during the investigations. This report also includes data and references from CRA's Phase 1 and Phase 2 investigations completed at the Site, the results of which are summarized in an August 2005 Remedial Investigation Report.

The Phase 1 and Phase 2 Remedial Investigations identified volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and inorganic compounds (metals) in soil and groundwater samples collected on the Site and along its western property boundary that were in concentrations above applicable MDEQ cleanup criteria. These investigations also identified DNAPL on the Site and along the western boundary. The highest concentrations of VOC, SVOC, metal and DNAPL constituents were typically identified within and west of the former Rouge River channel, which was abandoned in the early 1970's when the Army Corp of Engineers constructed a concrete channel and re-routed the river as part of a flood control project. Prior to the Army Corp project, this

western portion of the Site was a former oil storage area for a manufactured gas plant. As described later in this report, the former manufactured gas plant oil storage area was originally on the west side of the river, but was combined with the Site property on the East side of the river after the river was re-routed by the Army Corp. During the Phase 1 and Phase 2 investigations conducted at the Site, groundwater was encountered within Unconfined and Semi-confined conditions and was determined to flow in a westerly direction toward the new Rouge River channel. Based on the undefined soil, groundwater, and DNAPL impacts identified along the Sites western property line and the westerly groundwater flow direction, the MDEQ requested additional off-Site investigations be completed.

1.1 REMEDIAL INVESTIGATION OBJECTIVES

The objectives of the Phase 3 and IRA investigations were to:

- Assess soil quality in off-Site areas directly adjacent to the Site to define the lateral extent of chemical constituents that exceed applicable MDEQ criteria;
- Assess groundwater quality in off-Site areas directly adjacent to the Site to define the lateral extent of chemical constituents that exceed applicable MDEQ criteria;
- Assess and define the lateral extent of DNAPL in off-Site areas directly adjacent to the Site and evaluate its recharge and/or recovery options;
- Confirm and/or assess the groundwater quality entering the Rouge River through the pressure relief vents (PRVs) on the east and west sides of the Rouge River;
- Collect sufficient data to develop a plan to eliminate PRV discharges to the Rouge River where groundwater contains chemical concentrations exceeding applicable MDEQ criteria;
- Assess groundwater flow directions and potential preferential migration pathways in the Unconfined and the Semi-confined Saturated Zones in areas hydraulically downgradient of the Site;
- Assess the hydraulic relationships between the Unconfined Saturated Zone, the Semi-confined Saturated Zone, the current channelized section of the Rouge River, and the former un-channelized (abandoned) section of the Rouge River;
- Assess the volume of groundwater migrating off-Site and the fate and transport mechanisms of its chemical constituents.

- Identify potential receptors and exposure pathways for the chemical constituents detected in soil and groundwater.

1.2 REPORT ORGANIZATION

The remainder of this Supplemental Remedial Investigation Report is organized as follows:

- Section 1.0 – Introduction and Background
- Section 2.0 – Investigation Methodologies
- Section 3.0 – Aerial Photograph and File Reviews
- Section 4.0 – Geologic and Hydrogeologic Results
- Section 5.0 – NAPL Investigation Results
- Section 6.0 – Soil Investigation Results
- Section 7.0 – Groundwater Investigation Results
- Section 8.0 – Part 201 Pathway Analysis
- Section 9.0 – Phase 3 Summary and Conclusions
- Section 10.0 – Recommendations
- Section 11.0 – References

1.3 FACILITY LOCATION

The Schaefer Road Area Site is located on the east side of the re-aligned Rouge River at the southwest corner of Butler Road and Schaefer Road (Figure 1.1). The Site encompasses approximately 45 acres within Township 2 South, Range 11 East, Wayne County, Michigan. The Site occupies land in both the Cities of Dearborn and Melvindale. The Site is surrounded by Wayne County property to the West, City of Dearborn property to the North and the Ford/SNA Rouge Manufacturing Complex to the East and South. The southern portion of the Site contains the Severstal wastewater treatment plant (WWTP) and the northern portion of the Site is undeveloped. A chain link security fence surrounds the Site, providing security and a controlled access point for personnel operating the Site 24 hours per day 7 days a week.

1.4 HISTORY OF PROPERTY OWNERSHIP AND OPERATIONS

A detailed description of the Site history is presented in Section 1.4 of CRA's August 2005 RI Report. The current Site boundary combined two properties that were located on opposite sides of the Rouge River prior to the Army Corp flood control project. After re-routing the river, the Michcon Manufactured Gas Plant oil storage property on the west side of the Rouge River was combined with the Ford WWTP operations on the east side of the river (Figure 1.2). The adjacent property west of the Site and east of the concrete river channel was the main focus of the Phase 3 investigation. This property was also part of the manufactured gas plant and was owned by Michcon up until 1968. It was then transferred to Wayne County after the Army Corps completed the flood control project. An access agreement with Wayne County was required prior to initiating the Phase 3 investigation. An ownership history for the Site and the off-Site property west of the Site is presented below. A detailed Site chronology is presented in Table 1.1.

Site Property West of Original Rouge River

- 1860's –1968 (Michcon – 100+ years)
- 1968 – 1989 (Ford – 21 years)
- 1989 – 2002 (Rouge Steel Company – 13 years)
- 2002 – present (Severstal North America – 5 + years)

Site Property East of Original Rouge River

- 1953 – 1989 (Ford - 36 years)
- 1989 – 2002 (Rouge Steel Company – 13 years)
- 2002 – present (Severstal North America – 5 + years)

Off-Site Property West of Site

- 1860's –1968 (Michcon – 100+ years)
- 1968 – present (Wayne County 39+ years)

As discussed in the August 2005 Schaefer Road Area RI Report, the location and orientation of the new channelized Rouge River cut off 22 acres of the manufactured gas plant property (Figure 1.2). This 22-acre property was combined with the 13 acre Ford property on the east side of the river. The Site also includes another 10 acres of reclaimed land after the abandoned Rouge River channel was filled in. The U.S. EPA filled a portion of the abandoned channel with materials excavated from the former manufactured gas plant. Ford also filled portions of the original river channel with various fill materials from the Rouge Manufacturing Complex. It should also be noted

that approximately 1.5 of the 22 acres of the Michcon property acquired by Ford in 1968 was considered part of the former City of Melvindale Dump. Figure 1.3 shows the historic and present day land use of the Site.

1.5 CURRENT WWTP OPERATIONS

A description of the wastewater treatment process is presented in Section 1.5 of CRA's August 2005 RI Report. A current Site layout is presented on Figure 1.4. The predominant features of the WWTP and their construction dates are presented below.

- 1953 - two grit chambers, a pump station, two clarifiers, clarifier office
- 1953 – East and West Sludge Ponds
- 1969 - Primary Polishing Lagoon
- 1973 - Secondary Polishing Lagoon
- 1973 - Diked Lagoon

1.6 SITE UTILITIES AND STRUCTURES POTENTIAL INFLUENCE ON GROUNDWATER MIGRATION

The size, depth and location of Site utilities were summarized in Section 1.6 of the Schaefer Road Area August 2005 RI Report. Since the submittal of that report, a new 16-inch gas line has been installed at the Site. This line was installed underneath the Rouge River through directional drilling and then traverses along the north side of the Primary Lagoon in a 5-foot deep trench (Figure 1.3). Since the portions of the gas line that were installed at or below the water table were completed with a pressured mud system, its construction is not believed to have created any preferential groundwater migration pathways. However, there are numerous existing and abandoned subsurface utilities and structures at and/or adjacent to the Site that could influence groundwater migration (based on known or estimated invert elevations). These utilities and structures could provide vertical preferential groundwater migration pathways between the Unconfined and Semi-confined Saturated Zones or horizontal preferential pathways within the zones. As shown below, they have been divided into "active" and "abandoned" categories and are shown on Figure 1.5.

Active Utilities and Existing Structures

- 108-inch discharge (Outfall) from the Secondary Lagoon to the Rouge River
- 84-inch discharge from the Primary Lagoon to the Secondary Lagoon
- 72-inch discharge from the WWTP clarifiers to the Primary Lagoon
- 66-inch forcemain to the WWTP clarifiers
- 30-inch dewatering pipe below the Rouge Channel (backfill material only)
- 24-inch natural gas line crossing the Rouge in the Northwest corner of the Site
- 24-inch storm sewer bisecting southern property boundary
- 6-inch drain tile along the east and west banks of the Rouge River Channel
- Sheet Piling/Flow Distribution Wall in the Primary Polishing Lagoon
- Sheet Piling/Level Control Weir in the Primary Polishing Lagoon
- Sheet Piling/Level Control Weir in the Secondary Polishing Lagoon
- Sheet Piling along Secondary Polishing Lagoon west of the Tide Gates
- Sheet Piling on west edge of the West Sludge Pond
- Clarifier Office Basement Walls/Floor

Abandoned Utilities and Structures

- 12-inch natural gas line crossing the Rouge River near PRV-3E
- 24-inch storm sewer at the corner of Butler and Schaefer
- 30-inch dewatering drain tile below the centerline of the Rouge River Channel
- 96-inch diversion piping used (and removed) by Army Corp to temporarily re-route Rouge River

The presence of an abandoned 30-inch dewatering drain tile below the centerline of the Rouge River Channel was identified during a file review at the Army Corp office in Detroit, Michigan after the August 2005 RI Report was submitted to the MDEQ. The 30-inch pipe was apparently installed within a 4.5-foot wide by 6-foot deep trench that was backfilled with pea gravel (Figure 1.6). Subsequent follow-up conversations with engineering personnel responsible for field oversight of the Army Corps project confirmed the presence of this pipe, which is believed to run the entire length of the concrete channel (approximately 5 miles of the Rouge River from Michigan Avenue to the turning basin at the RMC). The plans indicate the 30-inch drain pipe was to have been filled with grout after completing the channel. The pea gravel filled trench will continue to function as a drain for the channel and prevent water from crossing the centerline line of the concrete river channel.

1.7 GEOLOGY, HYDROGEOLOGY, AND HYDROLOGY

A summary of the regional and Site geology, hydrogeology, and hydrology is presented in Sections 1.7 and 3.0 of the August 2005 Schaefer Road Area RI Report, respectively. The pertinent geologic and hydrogeologic information relating to the Phase 3 investigation is summarized below. General geologic cross-sections A-A' through F–F' show the relationships between the geology, hydrogeology and hydrology at and adjacent to the Site. These cross sections are presented in Appendix A.

Clay Unit – a 100-foot thick, laterally continuous clay layer is present across the entire Site and region. The clay layer acts as a low permeability base to the overlying saturated zones and retards vertical migration of the contaminants encountered at the Site.

Sand and Gravel Unit – the Rouge River incised a 25 to 35-foot deep channel into the clay layer and deposited a laterally discontinuous permeable sand layer in the incision. The sand deposits are saturated and generally the thickest within the former main channel (up to 15 feet) and generally decrease in thickness in lateral directions away from the main channel. The sand layer is also totally absent on the east side of the Site between the clarifier office and the tide gates where the clay deposits adjacent to the river were not eroded. Low permeability clayey sand/silty sand was deposited on top of the sand unit. (See description below)

Clayey Sand - This low permeability unit acts the upper confining layer to the sand and gravel unit below it. It also acts as a low permeability base to the groundwater encountered in the surficial fill unit above it. (See description below)

Surficial Fill Unit - The surficial fill material is generally at least 2 feet thick across the entire Site, and ranges up to 28 feet thick from surrounding grade surface at locations within the former Rouge River channel. The former River Rouge channel was filled by the USACE with soils from the current river channel and by Ford with by-product materials from the Rouge Manufacturing Complex. The fill materials also include soils excavated from the primary lagoon. The fill contains a thin laterally discontinuous saturated zone.

Hydrogeologic Conditions - Groundwater is encountered in unconfined conditions within the fill materials above the clayey sand unit. The Unconfined Zone is hydraulically connected to the semi-confined zone in areas where utilities or structures breached the bottom of the clayey sand/silty sand unit. These vertical conduits into the Semi-

confined Zone represent potential pathways for dissolved phase contaminants to enter the semi-confined zone, which is where the largest VOC and SVOC mass was encountered in previous investigations. Groundwater flow in the Semi-confined Zone is westerly toward the channelized Rouge River. Groundwater in the Unconfined Zone is toward the former and current Rouge River channels.

1.8 SUMMARY OF INVESTIGATIONS

With exception of the 1984 EDI Investigation, a detailed summary of each soil or groundwater investigation identified below was presented in Section 1.8 of the August 2005 Schaefer Road Area RI Report.

- 1969 – US Army Corps of Engineers
- 1984 - EDI Engineering & Science (EDI) Site Assessment of former Michcon property;
- 1986 and 1990 - Neyer, Tiseo, and Hindo (NTH) Geotechnical Investigation
- 1990 – USEPA Rouge River Fill Area;
- 1991 – Ford UST removal;
- 2002 and 2004 - CRA Phase 1 and Phase 2 RI

According to the EDI investigation report, manufactured gas operations began on the Michcon Site in the mid 1800's. A 1992 MDNR Site Screening Report indicated that the gas operations were conducted on the Michcon property between the 1860's and 1954. A map from the Detroit Gas Company, which later became Michcon, is presented on Figure 1.2. The 1984 EDI investigation was completed at the Michcon property after the company divested the 22 acres to Ford in 1968. Consequently, the EDI investigation was limited to areas west of the new concrete river channel (i.e., Michicon's Gas Distribution facility at 3900 Greenfield Road). During the investigation, EDI identified potential free-phase oil and/or coal tar in borings S-6, S-7, S-9 and W-1, all of which were located near the former tar separator and tar storage areas (Figure 1.3).

These EDI results are consistent with the 1967 and 1968 Army Corps investigation results that identified potential free-phase oil, tar, or oily material in borings 14-67, 15-67, 16-67, 14-68, 16-68, and 24-68 (Figure 1.3). It should be noted that Army Corps boring 13-67, which was completed on original Ford WWTP property, did not contain any references to free-phase oil, tar or oily materials.

2.0 INVESTIGATION METHODOLOGIES

The Phase 3 investigation and relevant portions of the Interim Response Activities consisted of the tasks identified below. The remainder of this Section summarizes the details and methodologies employed for each task.

- an aerial photograph and file review;
- a soil investigation;
- a groundwater investigation;
- a DNAPL investigation; and
- an interim response activity investigation.

2.1 AERIAL PHOTGRAPH AND FILE REVEIW METHODOLOGIES

Aerial photographs from multiple sources were reviewed for information regarding the historical use of the Site and the adjacent properties both before and after the Army Corps Rouge River Flood Control Project was completed in the early 1970's. The sources and dates of aerial photographs included in the review are summarized below:

- Wayne State University - 1949, 1952, 1956, 1961, 1967, 1981, and 1997;
- Ford Environmental Quality Office Archives - 1967, 1969, and 1976; and
- South East Michigan Council Of Governments – 1975;

In addition to the aerial photograph review, a file review was completed at the Army Corps - Geotechnical & Structural Division office in Detroit, Michigan to obtain design information on the subdrain system (i.e., drain tile and pressure relief vents) constructed within the banks of the Rouge River.

File reviews were also completed on State of Michigan and U.S. EPA files obtained through Freedom of Information Act (FOIA) requests. The files were reviewed to assess other potential sources of impacts identified at and/or adjacent to the Site. The first two facilities listed below are directly west of the Site. The last two facilities listed were U.S.EPA names for the Melvindale Dump, a portion of which is now located on the Site.

- Rouge River Fill Area (U.S. EPA ID# MID985569144);
- Michigan Consolidated Gas Company (U.S. EPA ID# MID980994776);
- City of Melvindale Transfer Station (U.S. EPA ID# MID981189970); and

- Melvindale Solid Waste Disposal Area (U.S. EPA ID# MID981189996).

2.2 SOIL INVESTIGATION METHODOLOGIES

Soil Boring Locations and Designations: During the Phase 3 RI, 30 soil borings were installed to collect soil samples and/or install monitoring wells. The location of each boring is presented on Figure 2.1. The location of each monitoring well is presented in Figure 2.2. Borehole and monitoring well completion details are presented on Table 2.1.

Of the 30 borings, 20 were completed on adjacent properties. Two of the remaining 10 borings were completed on-Site within the abandoned river channel to assess fill materials used at the Site. The final eight borings were completed at the Site along the western property line to install shallow monitoring wells in the Unconfined Zone (to assess groundwater quality and its potential to migrate off-Site). Soil borings that were not completed as monitoring wells were abandoned by grouting with a bentonite slurry and/or bentonite chips (i.e., borings GP-54, B-55, SB-56, GP-57 and GP-58 completed on the City of Dearborn property, the SNA property, or the MDOT property). The location and vertical elevation of each boring/monitoring well was surveyed to the North American Vertical Datum 1929 (NAVD29).

Sampling activities were generally completed according to methodologies and procedures discussed in the August 2005 Schaefer Road Area RI Report, although methods were varied as necessary to accommodate the specific features at each location.

Soil Boring Installation Methods: With exception of three shallow soil borings (i.e., GP-54, GP-57, and GP-58), all drilling activities were completed by Boart Longyear ENI of Flint, Michigan using a Rotosonic drill rig. The three shallow soil borings were completed by Altech Services, L.L.C. of Livonia, Michigan utilizing a Geoprobe (as these borings were not expected to extend through the semi-confining unit adjacent to the Site). The maximum depth drilled during the investigation was approximately 46 feet below grade. Soil cuttings from the drilling activities were collected in 55-gallon drums and transported to Waste Management's Woodland Meadows facility in Van Buren Township, Michigan for disposal. A copy of the manifests are presented in Appendix B. Stratigraphic and instrumentation logs are provided in Appendix C.

Soil Sample Collection: Continuous 10-foot soil samples were collected from the Rotosonic drill rig and continuous 5-foot soil samples were collected from the Geoprobe drill rig

during drilling activities. All soil sample collection methodologies were completed consistent with the April 2006 Phase 3 Work Plan and in accordance with the Quality Assurance Project Plan (QAPP) dated June 6, 2001.

Chemical Analysis of Soil Samples: Soil samples collected from the borings were submitted under chain-of-custody protocols to Severn Trent Laboratories (STL) of North Canton, Ohio. All samples were analyzed in accordance with the QAPP and consistent with the U.S. EPA methods utilized during previous investigations. Typically, at least two soil samples were submitted from each boring for analysis (i.e., an unsaturated sample that appeared to be most effected and a sample from the bottom of the boring). Since these bottom-most samples were from the ubiquitous silty clay layer that possess physical properties that impede vertical migration on a local and regional scale, an analysis of a bottom sample from every boring location was determined to be unnecessary. As requested by the MDEQ, additional analyses were conducted during the Phase 3 that weren't conducted in previous investigations were fine and course grained lead and trivalent chromium.

2.3 GROUNDWATER INVESTIGATION METHODOLOGIES

The groundwater assessment proceeded after installing monitoring wells in 25 of the 30 Phase 3 RI soil borings. The monitoring wells were used to: (1) assess groundwater quality in the Unconfined Zone along the western property boundary; (2) assess the groundwater quality in the Semi-confined Zone in off-Site areas along the Rouge River channel; and (3) asses the groundwater quality within the abandoned river channel in on-Site and off-Site areas. The monitoring wells were also used to obtain information on the hydraulic gradients and hydraulic conductivity's in both the Unconfined and Semi-confined saturated zones at the Site.

Monitoring Well Locations and Designations: In five of the 25 monitoring well locations, two wells were installed in the same borehole (at different levels) as the sand thickness encountered in the Semi-confined Zone was greater than 12 feet. These five well locations include MW-51, MW-52, MW-53, MW-68, and MW-72. Monitoring wells installed to screen the Unconfined Saturated Zone were labeled with an "S" designation and monitoring wells installed to screen the Semi-confined Zone were labeled with a "D" designation. At locations where two deep wells were installed at the same location within the Semi-confined Zone, the wells were labeled with a "D1" and "D2" designation, with the "D2" well being the deeper of the two. The location of each well

installed during the Phase 3 investigation, as well as all monitoring wells installed at the Site during previous investigations, is presented on Figure 2.2.

Monitoring Well Installation and Construction: All monitoring wells were constructed using standard MDEQ-approved methods identified in the Phase 1 Work Plan. The well installation details are presented in the borehole logs in Appendix C. All wells were constructed of 2-inch diameter, Schedule 40, PVC riser pipe and flush threaded, 0.010-slot, PVC screen. Screen lengths were dependent on the thickness of the saturated zone and ranged from 5 feet to 10 feet (the use of a 10-foot long screen was approved by the MDEQ). Table 2.1 summarizes the construction details of each well installed during the Phase 3 investigation. The location, top-of-casing elevation, and ground surface elevation of each well was surveyed by The Mannik & Smith Group of Dearborn, Michigan to the nearest 0.01 foot. All wells were developed to silt-free conditions by CRA after construction activities were complete. All monitoring well development water was containerized in a 1,500-gallon bulk polyethylene container and additional 300-gallon polyethylene totes. Based on the benzene levels in the water, the water was determined to be hazardous (D008) and was disposed of at the EQ-Detroit facility in Detroit, Michigan. Copies of manifests are presented in Appendix B.

Monitoring Well Gauging: Water levels were collected from all monitoring wells on October 23, 2006 and March 1, 2007 (Table 2.2). The water levels were collected to assess groundwater flow directions and hydraulic gradients. The potentiometric surface of the water table of the unconfined wells and the semi-confined wells were contoured using SURFER, a graphic software package. In addition to independent gauging events, water levels were also measured prior to collection of groundwater samples from each well.

Monitoring Well Groundwater Sample Collection: Groundwater samples were collected in October 2006 in accordance with MDEQ-approved low-flow sampling techniques and the methodologies presented in the Phase 1 Work Plan and QAPP.

Rouge River Pressure Relief Vent Groundwater Sample Collection: Seven pressure relief vents were identified on the west side of the Rouge River. These were arbitrarily labeled as PRV-1W to PRV-7W. In October 2006, groundwater was collected from six of the seven PRVs (PRV-5W was filled to grade with debris and could not be sampled). All PRV groundwater sample collection methodologies were consistent with those identified in the August 2005 RI Report. Based on the absence of any discoloration or odors, all purge water generated during the PRV sampling was discharged into the Rouge River

as approved by the MDEQ (as it was also consistent with the natural flow of the water that was sampled).

Chemical Analysis of Groundwater Samples: Groundwater samples collected from the monitoring wells and PRVs were submitted under chain-of-custody protocols to STL for chemical analysis. The analytical methods were similar to the soil analysis.

Single Well Hydraulic Recovery Testing: Hydraulic recovery tests were completed on 13 Phase 3 monitoring wells located along the concrete channel. The tests were completed during well development activities to estimate hydraulic conductivities of the semi-confined zone. These conductivity estimates were then used with the hydraulic gradient data to assess groundwater seepage velocities (i.e., average linear velocities). Data obtained from the tests were used to assess contaminant fate and transport scenarios and applicable aspects of potential groundwater remediation technologies.

Monitoring Well Variable Rate Step Testing: Three variable rate step tests ranging from 3 to 10 hours in duration were conducted at monitoring wells located along the Sites western property line. The step tests were completed to evaluate formation yield and capture zones, which will be used to assess sustainable groundwater extraction rates that may be required to establish hydraulic control at the Site (i.e., eliminate off-Site migration as a potential interim groundwater remedial action). Testing methods included utilizing a downhole pressure transducer in the pumping well and in select monitoring wells located hydraulically upgradient and downgradient of the pumping well (located both on-Site and off-Site) to monitor the change in water level elevations. Manual water level measurements were also collected at various times throughout the pumping tests to confirm the results of the pressure transducers. A Grundfos® pump with variable speeds was utilized to extract water from the pumping well. Flow rates at each pumping well were monitored by a timed bucket test, and the pumping rates were increased throughout each test until a maximum yield of the formation was established. All groundwater recovered during the testing was containerized in a 4,900-gallon poly container located within a secondary containment.

Rouge River Channel Subdrain Hydraulic Testing: As part of the IRA, hydraulic tests using multiple DataGators® were completed at each of the five pressure relief vent cleanouts on the east side of the river to obtain a quantitative estimate of the groundwater capture and discharge volumes associated with the subdrain system. A DataGator® is a modified Venturi flow tube with pressure transducers affixed to it at three locations (Figure 2.3). The water flow through the tube is calculated by converting the pressure

readings at the transducers directly into flow rates measured in gallons per minute. The factory calibrated DataGators® were placed into the 6-inch diameter inlet and outlet pipes of each vaultbox and sealed in-place with an inflatable rubber tube. The difference between the flow rate entering the vaultbox through the inlet and exiting the vaultbox through the outlet was assumed to be discharged out through the lateral to the Rouge River. The flow rates were recorded at one minute intervals and downloaded to a laptop computer.

Rouge River Surface Water Sample Collection: During the IRA, three surface water samples were collected approximately 6 inches below the top of the water surface using a polyethylene dipper cup attached to a long pole. The dipper cup was placed in the water and held in the sample spot for 1 minute prior to sample collection. The water was then immediately transferred to the appropriate sample containers. The samples were placed in an iced cooler and submitted under chain-of-custody protocols to STL for chemical analysis. The analytical methods were similar to the groundwater analyses.

2.4 DNAPL INVESTIGATION METHODOLOGIES

Liquid Phase Product Identification: DNAPL has been detected at the Site within the abandoned river channel and in areas west of the abandoned river channel, including several wells along the Sites western property boundary (i.e., MW-4D, MW-11D, MW-14D, MW-39D and MW-49D). Therefore, the wells completed on the Wayne County property (west of the Site) during the Phase 3 investigation were constructed so the screened interval straddled the basal clay layer to create a sump for DNAPL accumulation. The subsequent gauging activities were used to compare static DNAPL elevations to assess potential DNAPL source areas (as DNAPL migrates from high elevations to low elevations along low permeability layers).

Liquid Phase Product Sampling and Analysis: the methodologies used to gauge, sample and analyze DNAPL were identical to those used in Phase 1 and Phase 2 investigations. All DNAPL samples were submitted to STL for analysis of VOCs, SVOCs, PCBs, and Metals.

2.5 IRA INVESTIGATION METHODOLOGIES

IRA activities were conducted in response to the February 3, 2006 MDEQ-WHMD *Notice to Undertake Interim Response Activity*. The activities were conducted in accordance with

CRA's April 2006 *Interim Response Activity Work Plan* and the MDEQ-WHMD May 26, 2006 comment letter on the Work Plan.

The IRA Investigation activities included:

(1) confirming groundwater quality in on-Site wells where benzene concentrations exceeded MDEQ flammability and explosivity screening levels (i.e, MW-04D, MW-11D, MW-14D, and MW-47D);

(2) implementing quarterly free product gauging program with manual recovery (i.e., MW-04D, MW-4aD, MW-11D, MW-14D, MW-39D, and MW-49D);

(3) resampling groundwater within the Rouge River subdrain system (i.e., PRV-1E through PRV-5E); and

(4) Completing hydraulic testing within PRV-1E through PRV-5E to obtain a quantitative estimate of the groundwater capture and discharge volumes associated with the subdrain system.

3.0 AERIAL PHOTOGRAPH AND FILE REVIEWS

3.1 AERIAL PHOTOGRAPH REVIEW RESULTS

The aerial photographs reviewed for the Site are presented in Appendix D. The photographs in combination with the Gas Plant Site plan confirm that the former Michcon property that is now part of the Schaefer Road Site was used for manufactured gas plant operations, including oil and coal tar storage. The 1949 photograph shows the gas plant had constructed large surface impoundment areas adjacent to the Rouge River. In 1952, the impoundment appears to be partially full of liquid. In the 1956, 1961 and 1967 photographs, it appears the former impoundments are being backfilled with solid material. As a result of the 1968 property transaction between Michcon and Ford, the majority of the former impoundment area and a portion of an area once occupied by a 1,000,000-gallon aboveground storage tank (AST) are now located on the Site.

The photographs also show that until the installation of the Primary and Secondary Lagoons in 1969 and 1973, the entire WWTP was located on the east side of the original Rouge River. All light oil removal from the steel mill wastewater was completed on the east side of the river. The 1975 and 1997 photographs show the operations and layout of the WWTP have not changed since 1973.

3.2 ARMY CORPS ROUGE RIVER SUBDRAIN SYSTEM REVIEW RESULTS

The Army Corps file review was conducted to assess the subdrains associated with the concrete channel of the Rouge River. A drawing obtained during the file review identified a 30-inch de-watering pipe located under the centerline of the concrete river channel. The reference for this pipe is shown on Sheet 16 of 17 from the Army Corps River Rouge, Michigan Flood Control Project, dated April 30, 1976. As identified in Section 1.6 of this report, the 30-inch pipe was installed within a 4.5-foot wide by 6-foot deep trench that was backfilled with pea gravel (Figure 1.5) and abandoned in place by grouting when the channel construction was completed. The file review also confirmed the presence of five pressure relief vents constructed within the eastern concrete bank of the Rouge River and also identified 7 pressure relief vents located within the western concrete bank of the river. The locations of these pressure relief vents are shown on Figure 1.3. The pressure relief vents on each side of the river appear to be connected by multiple, laterally-continuous 400-foot sections of 6-inch diameter perforated drain pipe.

Each section is connected to a cleanout vault or storm sewer outfall. Each cleanout vault consists of a concrete box measuring approximately 2.5' wide x 2.5' long x 3.5' deep box that is similar to a storm sewer catch basin. Each vault contains an inlet pipe, an outlet pipe, and a lateral pipe that extends into the river. Each lateral is equipped with a flapgate constructed at the end of the discharge pipe (i.e., a pressure relief vent). A schematic for these pressure relief vents is presented on Figure 1.5.

The file review also contained a 1980 Army Corps Rouge River Inspection correspondence citing "an oil slick" on the Rouge River approximately 500 feet downgradient from Greenfield Road, which correlates to the north west corner of the Site.

3.3 ROUGE RIVER DOCUMENT REVIEW RESULTS

CRA reviewed a copy of the July 1998 report entitled *Rouge River National Wet Weather Demonstration Project, Assessment of Toxic Contaminants: 1996 Dry Weather Toxics Assessment Survey Results*. The report detailed the findings of water and sediment samples collected at specific locations within the Rouge River. The closest surface water sample location to the Site was collected approximately 6,000 feet upstream at Station G41 (near Rotunda Drive). The analytical results of the surface water sample did not detect naphtlalene or other PAH compounds but several of the inorganic constituents detected at Station G41 were also detected in the PRV samples (i.e., detections of total lead, chromium and copper and estimated concentrations of nickel and zinc). The concentrations of chromium, copper, lead, nickel, zinc and PCBs were below the Rule 57 Water Quality Values. If a mixing zone based GSI criteria were to be developed for the Site, these detections would be considered background concentrations of the "receiving water".

3.4 MISCELLANEOUS FILE REVIEW RESULTS

As part of the Phase 3 investigation, CRA submitted freedom of information act requests for the off-Site properties located adjacent to the Site (shown below). A summary of the information is presented below.

- City of Melvindale Transfer Station (U.S. EPA ID# MID981189970);
- Melvindale Solid Waste Disposal Area (U.S. EPA ID# MID981189996);

- Michigan Consolidated Gas Company (U.S. EPA ID# MID980994776);
- Rouge River Fill Area (U.S. EPA ID# MID985569144).

City of Melvindale Transfer Station and Melvindale Solid Waste Disposal Area: In December 1987, the U.S. EPA completed a Potential Hazardous Waste Site Preliminary Assessment for each of these two properties associated with the former Melvindale Dump. The addresses for the properties were listed as 3101 Greenfield Road and "Greenfield west of Schaefer", respectively. The U.S.EPA did not complete a property inspection prior to completing the reports. Additionally, the "status", "years of operation", and "type of ownership" were identified as "unknown" in the US.EPA report. The report indicated "No Further Action" was warranted. Based on a review of the aerial photographs presented in Appendix C, the filling operations at the Melvindale Dump appear active from at least 1949 to 1967. These dates are consistent with information presented in the 1992 U.S.EPA/MDEQ Screening Site Inspection report (see the summary below on the Rouge River Fill Area). The screening site inspection report indicated the Melvindale Dump operated between the 1940's and 1975. A 1.5 acre portion of the former dump remains on the Schaefer Road Area Site (Figure 1.3).

Michigan Consolidated Gas Company: In 1986 the US.EPA completed a Site Description/Executive Summary and Potential Hazardous Waste Site Preliminary Assessment for the Michcon Consolidated Gas Company Gas Distribution facility located at 3900 Greenfield Road in Dearborn, Michigan. The Executive Summary indicates the property "has been extensively contaminated as the result of the storage of raw coal materials and by coal tar solids that are the by-products of the coal gasification process". The U.S. EPA recommended follow-up studies to determine the direction and rate of groundwater flow, mobility of soil contaminants, and the effects of any contaminants from the Site being discharged into the Rouge River.

Rouge River Fill Area: In 1992, at the request of the U.S. EPA, the Michigan Department of Natural Resources (now the MDEQ) completed a Screening Site Inspection (SSI) of the Rouge River Fill Area, which was a name given to an area that encompassed a portion of the current Gas Distribution property and former Gas Plant property adjacent to the Rouge River (i.e., Current Wayne County property on both sides of the current Rouge River channel). The Site Screening Inspection included collecting and analyzing:

- 10 soil samples on the Gas Distribution property and Wayne County property;
- 4 groundwater samples from PRV-2E, PRV-2W, PRV-4E, and PRV-7W;
- 4 sediment samples from the PRV vault boxes;

- 3 surface water samples from the Rouge River;
- 3 sediment samples from the Rouge River; and
- 2 soil samples from the "Unused Area" of the Site.

The Site Screening Inspection Report indicates "The Rouge River Fill Area site consists of areas where contaminated soil and coal tar wastes were used as fill materials prior to and during the rerouting of the River Rouge channel. Contaminated soil and coal tar wastes have been found on both sides of the present River Rouge channel covering an area of approximately 117.5 acres (Amber, 1991). The coal tar wastes originated from a coal gasification plant that was located on the south side of the River Rouge on the present day Michigan Consolidated Gas Company (MichCon) property (MID980994776)". Results of the Site Screening Inspection identified VOCs, SVOCs, and Metals in soil, groundwater, and surface water that were attributable to historic gas plant operations. The highest VOC and SVOC concentrations were detected in sediment sample from pressure relief vent PRV-4E, which showed similar constituents at lower concentrations than those detected in the Phase 2 and Phase 3 investigations. Additionally, the sediment sample collected at PRV-4E (i.e., SSI sample SCBS5) detected the following constituents (plus estimated concentrations of other constituents not shown below). These detected constituents are similar to those detected during the Phase 1, 2 and 3 RI investigations.

Constituent	Concentration
Anthracene	10 ppm
Benzo(a)pyrene	20 ppm
Benzo(b)fluoranthene	12 ppm
Benzo(g,h,I)perylene	11 ppm
Chrysene	19 ppm
Fuoranthene	35 ppm
Fluorene	11 ppm
Naphthalene	28 ppm
Phenanthrene	73 ppm
Pyrene	73 ppm

Constituent	Concentration
Aluminum	16,200 ppm
Copper	179 ppm
Cyanide	87.9 ppm
Nickel	99 ppm

A copy of the SSI is included on the CD in Appendix E.

4.0 GEOLOGIC AND HYDROGEOLGIC RESULTS

4.1 GEOLOGIC RESULTS

The Phase 3 soil borings confirmed the presence of four geologic units on and adjacent to the Site (i.e., a Fill Unit, a Clayey Sand Unit, a Sand and Gravel Unit, and a Silty Clay Unit). This Phase 3 geologic data was combined with the geologic data from the Army Corps investigation to assess changes in the thickness and/or surface elevations of the Sand and Gravel Unit and the Silty Clay Unit caused by the construction of the concrete channel for the Rouge River. As discussed in Section 1.6, the Army Corps installed a 30-inch dewatering pipe below the centerline of the Rouge River Channel. The 30-inch pipe was installed within a 4.5-foot wide by 6-foot deep trench. The trench excavation for the river channel and the trench excavation for the 30-inch pipe below the channel required the Army Corps to remove portions of both geologic units. Figures 4.1 and 4.2 present the thickness of the Sand and Gravel Unit before and after the channel was completed. Figures 4.3 and 4.4 present the contoured surface of the Silty Clay Unit before and after the channel was completed. As shown by the figure, the current clay surface slopes toward the former Rouge River and toward the current Rouge River (i.e., toward the areas highlighted in yellow).

Two geologic cross sections were prepared (G-G' and H-H') to assess the hydrogeologic conditions perpendicular to and parallel to the river channel. The monitoring well location map (Figure 2.2) shows the orientation of the cross sections. Geologic cross section G-G' (Figure 4.5) is oriented perpendicular to the river and utilized data from Phase 2 and Phase 3 soil borings. The cross section shows:

- the surface water elevations decrease sequentially from the Primary Lagoon, to the Secondary Lagoon to the Rouge River and likely affects groundwater hydraulic gradients within the Unconfined Zone and the Semi-confined Zone; and

- the Sand and Gravel Unit and the Silty Clay Unit are laterally continuous between the former Rouge River channel and the new river channel, indicating potential hydraulic connection between the two features. Additionally, the sand and gravel unit is absent east of the former Rouge River, indicating the pathway is limited to the west side of the former channel.

General geologic cross section H-H' (Figure 4.6) was prepared to assess the geologic and hydrogeologic conditions parallel to the Rouge River channel. The cross section

includes an overlay of the Rouge River features, including the top elevation of the concrete channel, the bottom elevation of the concrete channel, and the elevation of the subdrain and pressure relief system. The section also shows an overlay of the top and bottom elevation of the 30-inch pipe and the bottom elevation of the trench it was installed in. The overlays and the water levels on cross section H-H' show:

- the bottom elevation of the Sand and Gravel Unit at several locations along the river (i.e., at MW-59D, MW-68D, MW-71D and MW-72D) is below the bottom elevation of the concrete channel, indicating groundwater within the Semi-confined Zone could migrate under the river in a limited number of areas;

- the bottom of the Sand and Gravel Unit within the former river channel (i.e., near MW-71D) is below the bottom elevation of the trench for the 30-inch pipe, indicating the former channel could be a groundwater migration pathway where the channel and trench intersect; and,

- the abandoned/buried gas line near MW-67D and/or the former river channel appear to act as preferential migration pathways as the groundwater elevations in those areas are the lowest along the new river boundary.

4.2 HYDROGEOLOGIC RESULTS

Unconfined Zone: As shown on Figure 4.7, the groundwater hydraulic gradients in the Unconfined Zone vary across the Site and the properties adjacent to the Site. In the central portion of the Site, the hydraulic gradients in the Unconfined Zone are towards the Primary Lagoon and Secondary Lagoons. In the northwestern portion of the Site, the hydraulic gradients are toward the former Rouge River channel. On the Wayne County property west of the Site, the hydraulic gradients are westerly towards the subdrain system in the banks of the Rouge River Channel. Based on a 7-foot difference in static water elevations and 10-foot difference in ground surface elevations, the Unconfined Zone at the Site does not appear to be hydraulically connected with the Unconfined Zone on the Wayne County property.

Semi-confined Zone: As shown on Figure 4.8, the groundwater hydraulic gradients in the Semi-confined Zone are towards the Rouge River channel and the 30-inch dewatering drain pipe constructed below the river channel. The hydraulic gradients are relatively flat within the footprint of the Secondary Lagoon where the surface waters are believed

to recharge to Semi-confined Zone. The hydraulic gradients also appear to be influenced in areas of the former Rouge River channel and in areas near the Secondary Lagoon Outfall, where the 84-inch diameter piping breaches the semi-confined zone. The construction of the Secondary Lagoon created artificially high water levels on-Site while the excavations for the Rouge River channel created lower water levels off-Site. The result of these two construction events reversed the natural hydraulic gradient and groundwater flow direction. Prior to the completion date of the Secondary Lagoon (1973), the groundwater flow direction in the former impoundment area would have been toward the former river channel and after 1973, the hydraulic gradient and groundwater flow direction is toward the new river channel.

4.3 SEMI-CONFINED ZONE HYDRAULIC TESTS RESULTS

In October and November 2006, 13 hydraulic recovery tests and three step-drawdown tests were completed to assess the hydraulic properties of the Semi-confined Zone. The pump down tests were completed in off-Site wells installed along the river channel and the step draw-down tests were completed in on-Site monitoring wells located along the western property boundary (i.e., MW-9D, MW-36D, and MW-38D). The hydraulic recovery tests were conducted as part of the well development activities and the step down drawdown tests were conducted after the groundwater sampling activities were completed. Each of the wells tested was screened across the entire thickness of the Semi-confined Zone or at least 3 feet of the bottom portion of the formation (as the wells were constructed with collection sumps below the clay interface). Additional details on the test results from each pumping well are discussed below and are presented on Figure 4.9 and Appendix F.

Hydraulic Recovery Test Results: The results of the 13 hydraulic recovery tests are summarized in Table 4.1. As shown in the table, the average hydraulic conductivity of the wells installed along the river channel is approximately 1.219×10^{-4} feet per second (or 3.72×10^{-3}cm/sec). The recovery curves from the tests are presented in Appendix F.

MW-9D Step Test Results: Prior to conducting the pumping test at MW-9D, the static water level within the well was 13.80 feet below the top of casing. The Semi-confined Zone at this location is approximately 3 feet thick with the top of the unit encountered 20.4 feet below the top of casing, indicating a total potential head of 6.6 feet (20.4 –13.8 = 6.6 feet). At the start of the test, an initial pumping rate of 3 gallons per minute (gpm) at MW-9D was sustained for 30 minutes. Pumping rates were increased by 1 gpm every

half hour up to 6 gpm, the maximum flow rate of the pump. The pump was allowed to run for 160 minutes at 6 gpm, at which time the test was terminated and recovery gauging was initiated until 90% recharge was achieved. Results of the tests indicate 4.5 feet of drawdown will occur at the well at a 6 gpm extraction rate. Based on the recovery data, the estimated hydraulic conductivity of the Semi-confined Zone in this area of the Site is approximately 1.23×10^{-2} feet per second (or 3.74×10^{-1} cm/sec). The groundwater monitoring conducted at surrounding wells MW-67D, MW-69D, and MW-70D showed no hydraulic influence from the pumping operations conducted at MW-9D, which suggest that (1) additional monitoring point located closer to the extraction well would be required to estimate the capture zone and/or (2) a longer duration step drawdown test would be required if not additional monitoring wells are installed. The estimates from any hydraulic tests completed at or adjacent to the Site are complicated by the variable thickness of the sand unit; the variable composition of the sand unit, the variable elevation of the river and lagoons, and the variable recharge rates across the Site. A groundwater sample was collected for analysis of VOCs prior to terminating the hydraulic test.

MW-36D Step Test Results: Prior to conducting the pumping test at MW-36D, the static water level within the well was 15.7 feet below the top of casing. The Semi-confined Zone at this location is approximately 2 feet thick with the top of the unit encountered 19.7 feet below the top of casing, indicating a total potential head of 4 feet (19.7 - 15-7 = 4.0 feet). At the start of the test, an initial pumping rate of 0.5 gpm was utilized. This flow rate was sustained for 225 minutes as a steady state condition could not be established and decreasing water levels within the well were observed throughout the test. After 225 minutes, the pump was shut off due to low water levels within the well (less than 1 foot). Recovery gauging was initiated until 90% recharge of the initial water level was achieved. Results of the tests indicate 6.0 feet of drawdown will occur at the well at a 0.5 gpm extraction rate. Based on the recovery data, the estimated hydraulic conductivity of the Semi-confined Zone in this area of the Site is approximately 1.08×10^{-3} feet per second (or 3.29×10^{-2} cm/sec). The groundwater monitoring conducted at surrounding wells MW-14S, MW-14D, MW-17D, MW-18D, MW-65D, MW-66D, and MW-67D showed no hydraulic influence from the pumping operations conducted at MW-36D, which lead to the same conclusions identified in the step test conducted at MW-9D. No groundwater samples were collected from the well following pumping.

MW-38D Step Test Results: Prior to conducting the pumping test at MW-38D, the static water level within the well was 13.5 feet below the top of casing. The Semi-confined Zone at this location is approximately one foot thick and was encountered between 27

and 28 feet below the top of casing, indicating a total potential head of 13.5 feet (27.0 – 13.5 = 13.5 feet). At the start of the test, pumping was initiated at 0.5 gpm and sustained for 38 minutes. Pumping was increased by 0.5 gpm every half hour until 3.0 gpm was achieved. An additional increase in gpm was attempted (up to 3.2 gpm), but the well went dry within 30 seconds of this increase. Therefore, the pump was slowed down and sustained at 3.0 gpm for 6.8 hours until shutdown. Recovery gauging was initiated until 90% recharge was achieved. Results of the tests indicate 15 feet of drawdown will occur at the well at a 3 gpm extraction rate. Based on the recovery data, the estimated hydraulic conductivity of the Semi-confined Zone in this area of the Site is approximately 1.31×10^{-2} feet per second (or 3.99×10^{-1} cm/sec). Of the six wells monitored during the test (i.e., MW-9D, MW-14S, MW-14D, MW-67D, MW-68D2, MW-69D) only off-Site well MW-68D2 showed any hydraulic influence from the pumping operations conducted at MW-38D. Well MW-68D2 is located approximately 150 feet downgradient of the extraction well. A groundwater sample was collected for analysis of VOCs, SVOCs, PCBs, and Metals approximately 1 hour before shut down. The analytical results reported VOC and SVOC concentrations higher than those identified in a pre-pumping sample collected from MW-38, indicating this well is close to a source area.

4.4 ROUGE RIVER SUBDRAIN SYSTEM HYDRAULIC TESTS RESULTS

Subdrain Hydraulic Testing: As part of the IRA, hydraulic tests using multiple DataGators® were completed at each of the five vaultboxes constructed for pressure relief vents PRV-1E through PRV-5E on the east side of the river. The tests were conducted to obtain a quantitative estimate of the groundwater capture and discharge volumes associated with the subdrain system. Representative portions of each hydraulic test (approximately 10 minutes) is presented on Figures 4.9 and 4.10. The readings presented in the figures were collected from two single monitoring events under normal flow conditions, and do not take into account potential lower-flows during the late summer or a suspected spike in flows following precipitation events.)

Estimated PRV Discharge: As shown in Figure 4.10, the July 2006 PRV hydraulic testing event showed the drain tile laterals at PRV-1E, PRV-2E, PRV-4E, and PRV-5E averaged discharge rates to the river of approximately 24, 43, 33 and 19 gpm, respectively (i.e., or a total of approximately 120 gpm). As shown in Figure 4.11, the August 2006 PRV hydraulic testing event showed the pressure relief vents at PRV-1E, PRV-2E, PRV-4E and PRV-5E was approximately 9, 16, 26, and 11 gpm, respectively (i.e., or a total of

approximately 67 gpm). During the two testing events, the pressure relief vents at PRV-3E showed an intake of 14 gpm and 7 gpm, respectively. This abnormal flow direction may be related to the absence of a flapgate in the river at this vent location. The total estimated discharge of 67 to 120 gpm through PRV-1E, PRV-2E, PRV-4E, and PRV-5E does not include potential discharge through the flap gate on the end of the 6-inch drain tile where it discharges to storm sewer located near the southwest corner of the Site. This flap gate appeared to be sealed shut during both testing events. Additional details are presented in a CRA memorandum entitled "Results of MDEQ-requested Interim Response Actions" submitted the MDEQ in October 2006.

5.0 NAPL INVESTIGATION RESULTS

The Phase 3 investigation identified oily residual soils in seven soil borings, including: SB-52, SB-62, SB-66, SB-67, SB-68, SB-69, and SB-71. With exception of SB-52, all of these borings were located on Wayne County property directly west of the Site (Figure 5.1). Soil boring SB-52 was located on-Site near the Diked Lagoon west of the former Rouge River. Based on the potential for non-aqueous phase liquids (NAPL) to be present in the borings (and within the Sand and Gravel Unit), monitoring wells were installed at each of these seven locations. Subsequent gauging activities identified DNAPL at one location (MW-68D2) and LNAPL at one location (MW-62D).

Six of the Phase 3 soil boring locations where oily residuals and/or NAPL were encountered are located within or adjacent to the surface impoundment's operated by the former gas plant. Each of these six locations are west of the former Rouge River in the same vicinity where NAPL or oily residual soils have been identified in previous investigations completed at or adjacent to the Site (by CRA or the Army Corps). Figure 5.1 presents a summary of locations where oily residuals have been identified. The figure also includes locations where NAPL has been or continues to be detected (i.e., MW-4aD, MW-4D, MW-14D, MW-39D, and MW-49D). As shown in Table 5.1, these oily residuals are typically encountered at depths between 15 and 34 feet below grade (within the Semi-confined Zone/saturated Sand and Gravel Unit).

The following sections summarize the Phase 3 DNAPL and LNAPL investigation. Where adequate sample volume was available, NAPL samples were collected and analyzed for VOCs, SVOCs, PCBs, and inorganics. The analytical results are presented in Tables 5.2, 5.3 and 5.4. A summary of the constituents detected in the NAPL and its estimated aerial extent are summarized on Figure 5.2.

5.1 DNAPL INVESTIGATION RESULTS

DNAPL Detection, Location, Description and Thickness: DNAPL has been confirmed in one off-Site semi-confined well (MW-68D2) installed during the Phase 3 investigation. The visual and physical characteristics of the DNAPL detected at off-Site well MW-68D2 are similar to the DNAPL detected in on-Site wells in the Phase 1 and 2 investigations, including a brown/black color, moth ball odor, and a highly viscous nature. The thickness of DNAPL detected at this well has ranged between 0.5 and 1.0 foot. Manual product recovery has been initiated at this well.

DNAPL Composition: As shown in the table on page 30, the predominant organic constituents identified in the DNAPL sample from off-Site well MW-68D2 are generally similar to the predominant organic constituents identified in the DNAPL samples previously collected on-Site. As shown in Figure 5.1, the concentrations identified in off-Site well MW-68D2 are within the same order of magnitude as those identified in the DNAPL samples collected from on-Site wells MW-04D, MW-14D, and MW-39D (Tables 5.2 through 5.4).

The similar constituents identified between the on-Site and off-Site DNAPL samples and the similar concentrations reported in the analytical results suggest the DNAPL is from a similar source. The areas where DNAPL was encountered and the slope of the clay layer that controls potential DNAPL migration indicates the DNAPL originated on the west side of the former Rouge River near the former tar pond. The distribution of DNAPL also correlates well with: (1) the location of the former surface impoundment's on the former gas plant property; (2) the distribution of residual phase VOCs and SVOCs detected in soil at and adjacent to the Site; and (3) the distribution of dissolved phase VOCs and SVOCs detected in groundwater at and adjacent to the Site. Collectively, this analytical data and the absence of DNAPL detected on the east side of the former Rouge River Channel indicates that the source of the DNAPL and the VOC and SVOC constituents detected in soil and groundwater originated on the former manufactured gas plant property in the vicinity of the surface impoundment's. The metal concentrations identified in the DNAPL samples vary greatly, with concentrations at MW-68D2 generally higher than those detected in the other DNAPL samples (Table 5.4 and Figure 5.2).

PREDOMINANT VOCS AND SVOCS DETECTED IN DNAPL AND LNAPL
(in Alphabetical Order)

	DNAPL (On-Site) VOCs & SVOCs	DNAPL (Off-Site) VOCs & SVOCs	LNAPL (On-Site) VOCs & SVOCs	LNAPL (Off-Site) VOCs & SVOCs
VOCs				
1.	1,2,4-TMB	1,2,4-TMB	1,2,4-TMB	1,2,4-TMB
2.	1,3,5-TMB	1,3,5-TMB	1,3,5-TMB	1,3,5-TMB
3.	Benzene	Benzene	Benzene	Benzene
4.	Ethylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene
5.	Styrene	Styrene	Styrene	Styrene
6.	Toluene	Toluene	Toluene	Toluene
7.	Xylenes	Xylenes	Xylenes	Xylenes
SVOCs				
1.	2-Methylnaphthalene	2-Methylnaphthalene	2-Methylnaphthalene	2-Methylnaphthalene
2.	Acenaphthene	Acenaphthene	Acenaphthene	Acenaphthene
3.	Acenaphthylene	Acenaphthylene	Acenaphthylene	Acenaphthylene
4.	Anthracene	Anthracene	Anthracene	Anthracene
5.	Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene	Benzo(a)anthracene
6.	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene
7.	Benzo(b)fluoranthene	Benzo(b)fluoranthene	Benzo(b)fluoranthene	Benzo(b)fluoranthene
8.	Benzo(g,h,I)perylene	Benzo(g,h,I)perylene	Benzo(g,h,I)perylene	Benzo(g,h,I)perylene
9.	Benzo(k)fluoranthene	Benzo(k)fluoranthene	Benzo(k)fluoranthene	Benzo(k)fluoranthene
10.	Biphenyl	Biphenyl	Biphenl	Biphenyl
11.	Chrysene	Chrysene	Chrysene	Chrysene
12.	Fluoranthene	Fluoranthene	Fluoranthene	Fluoranthene
13.	Fluorene	Fluorene	Fluorene	Fluorene
14.	Naphthalene	Naphthalene	Naphthalene	Naphthalene
15.	Phenanthrene	Phenanthrene	Phenanthrene	Phenanthrene
16.	Pyrene	Pyrene	Pyrene	Pyrene

DNAPL Recovery and Recharge: DNAPL recovery events at MW-68D2 have been completed and will continue as part of the Site-wide recovery events. As Due to the relatively slow DNAPL recharge to the wells and/or its limited thickness, Ford and SNA have implemented a quarterly free product gauging program with manual recovery conducted as necessary. The program utilizes the same protocols and methodologies from the Phase 1 and 2 investigation (bailing) but incorporates updated health and safety protection requirements.

5.2 LNAPL INVESTIGATION RESULTS

LNAPL was not initially encountered during the Phase 3 soil boring and monitoring well installation activities. Subsequent gauging activities (March 1, 2007) have identified a measurable thickness of LNAPL in monitoring well MW-62D. At this time, a sample of the product has not been collected and additional gauging/removal activities will be required to assess if sufficient volume is present at the location to continue recovery operations. Monitoring Well MW-44D is the only other well at or adjacent to the Site where LNAPL is detected. Based on the locations of these two wells, the source of LNAPL could be related to the fill materials used to backfill the former Rouge River. Alternatively, the LNAPL at MW-62D could be related to the Sludge Pond operations.

Based on the slow recharge and continued limited thickness of LNAPL, CRA has installed an oil absorbent sock in monitoring wells MW-44D and MW-62D to assist with the removal operations.

6.0 SOIL INVESTIGATION RESULTS

The following sections of the report summarize soil sample analytical results from the Phase 3 remedial investigation. The analytical data includes results from:

- 2 soil samples collected from the on-Site Fill Unit;
- 11 soil samples collected from the off-Site Fill Unit;
- 8 soil samples and 2 duplicates collected from the Clayey Sand/Silty Sand Unit;
- 1 soil sample collected from an unsaturated interval of the Sand and Gravel Unit;
- 12 soil samples collected from the Silty Clay Unit.

Of the 34 samples submitted for analysis, all but two (i.e., soil samples from SB-51 and SB-52) were collected from adjacent off-Site properties. All soil samples submitted to the laboratory were analyzed for VOCs, SVOCs, PCBs, and/or inorganics in accordance with methods identified in the Work Plan. The analytical results were validated in accordance with the procedures outlined in the QAPP. All sample delivery groups (SDGs) containing sample data collected during the investigation were assessed for compliance with method guidelines and project-specific requirements. All data qualifiers identified during the data validation activities have been incorporated into the analytical results presented in Tables 6.1 (VOCs), 6.2 (SVOCs), 6.3 (PCBs), and 6.4 (Metals). The validated results were compared to Table 3, *"Soil Industrial and Commercial II, III and IV Part 201 Generic Cleanup Criteria and Screening Levels"* as presented in MDEQ RRD Operational Memorandum No. 1, dated January 23, 2006. These criteria have been summarized in Table 6.5. Data validation memoranda for the Phase 3 analytical data are presented in Appendix G. A copy of the soil sample analytical results is included on the CD presented in Appendix H.

The remainder of this Section summarizes the soil sample analytical data by geologic unit. This included the Fill Unit, the Clayey Sand Unit, the Sand and Gravel Unit, and the Silty Clay Unit. Each subsection compares and screens the analytical data identified in the unit against the applicable soil cleanup criteria presented in Table 6.5. Additionally, as shown in Tables 6.1, 6.2, 6.3, and 6.4, some soil sample report limits and method detection limits were elevated due to moisture content or interference and are reported at limits required to successfully analyze the samples. Review of the limits for the non-detect results indicate that some of the data was reported as non-detect at a detection limit greater than MDEQ criteria. Therefore, although specific VOCs, SVOCs, PCBs, or Metals were "not detected" and shown as an "ND", the result shown on the analytical summary tables includes qualifiers associated with the potential criteria

exceedance. The chemical constituents associated with these potential "ND" exceedances are not discussed in any of the following sections but are identified in the tables.

Each of the soil samples analyzed during the Phase 3 investigation is identified in the table below. These samples were submitted to STL for laboratory analysis of VOCs, SVOCs, PCBs and/or metals. With exception of the soil samples collected from soil borings SB-51 and SB-52, all soil samples were collected from adjacent off-Site properties. The table below also identifies the geologic unit and the sample depth of each of the samples submitted for analysis. As shown in the table, 13 soil samples were collected from the Fill Unit, 10 soil samples were collected from the Sandy Clay Unit (including two duplicate samples), 1 soil sample from the Sand and Gravel Unit, and 12 soil samples were collected from the Silty Clay Unit. The samples selected for analysis were from the unsaturated interval exhibiting the highest PID reading (as organic compounds have a greater potential to migrate through the unsaturated zone and into shallow groundwater) or from the bottom of the boring.

SOIL SAMPLE SUMMARY BY GEOLOGIC UNIT

# of Samples	Fill Unit	Sandy Clay Unit	Sand and Gravel Unit	Silty Clay Unit
1.	**SB-51 (2.5-5.0) ***	SB-53A (5.0-7.0)	SB-65 (3.5-4.5)	SB-51 (32.5-35.0) *
2.	**SB-52 (7.5-10.0) ***	SB-53A (5.0-7.0) Dup		SB-53 (17.0-18.0)
3.	SB-54 (2.0-4.0)	**SB-59 (3.0-5.0)**		SB-55 (2.5-5.0)
4.	**SB-56 (5.0-7.5)**	**SB-66 (3.0-5.0)**		SB-59 (17.0-18.0)
5.	**SB-57 (6.0-8.0)**	**SB-67 (4.0-6.0)**		SB-63 (23.0-25.0)
6.	**SB-58 (6.0-8.0)**	**SB-68 (2.5-5.0)**		SB-64 (12.0-13.0)
7.	SB-60 (3.0-5.0)	**SB-69 (2.5-5.0)**		SB-65 (12.0-13.0)
8.	**SB-61 (12.5-15.0)**	SB-70 (5.0-7.5)		SB-66 (12.0-13.0)
9.	**SB-62 (8.0-10.0)**	SB-70 (5.0-7.5) Dup		SB-67 (12.0-13.0)
10.	**SB-62 (12.0-14.0)**	**SB-71 (10.0-12.5)**		SB-68 (20.0-22.5)
11.	SB-63 (8.0-10.0)			SB-70 (15.0-17.5)
12.	SB-64 (3.5-4.5)			SB-72 (16.5-18.0)
13.	SB-72 (3.0-5.0)			

Bold text - Denotes soil sample analytical results that identified an exceedance of one or more MDEQ criteria

* - Denotes soil sample collected from Site, all others collected from Off-Site areas.

6.1 VOC AND SVOC SOIL SAMPLE ANALYTICAL RESULTS

The VOC and SVOC soil sample analytical results are presented in Tables 6.1 and 6.2 respectively. The on-Site VOC and SVOC constituents detected during the Phase 1, 2, or 3 investigations that exceed MDEQ criteria are summarized on Figure 6.1 and the off-Site VOC and SVOC exceedances are summarized on Figure 6.2. The table below summarizes the VOC and SVOC constituents that exceeded MDEQ criteria by geologic unit. A description of the VOC and SVOC exceedances are presented below.

# of VOCs and SVOCs	Fill Unit (On-Site) VOC & SVOC Exceedances	Fill Unit (Off-Site) VOC & SVOC Exceedances	Sandy Clay (Off-Site) VOC & SVOC Exceedances	Silty Clay (Off-Site) VOC&SVOC Exceedances
VOCs				
1.	1,2,4-TMB	1,2,4-TMB	1,2,4-TMB	No
2.	1,3,5-TMB	1,3,5-TMB	1,3,5-TMB	VOC
3.	Benzene	Benzene	Benzene	Criteria
4.	Ethylbenzene	Ethylbenzene	Ethylbenzene	Exceeded
5.	Styrene *	----	Styrene	In
6.	Toluene *	----	Toluene	Phase 3
7.	Xylenes	Xylenes	Xylenes	Borings
8.			Methylene Chloride	
SVOCs				
1.	2-Methylnaphthalene	----	2-Methylnaphthalene	No
2.	Acenaphthene	----	Acenaphthene	SVOC
3.	Acenaphthylene	Acenaphthylene	Acenaphthylene	Criteria
4.	Anthracene	----	Anthracene	Exceeded
5.	Benzo(a)pyrene	Benzo(a)pyrene	Benzo(a)pyrene	In
6.	Dibenzofuran	----	Dibenzofuran	Phase 3
7.	Fluoranthene	Fluoranthene	Fluoranthene	Borings
8.	Fluorene	Fluorene	Fluorene	
9.	Naphthalene	Naphthalene	Naphthalene	
10.	Phenanthrene	Phenanthrene	Phenanthrene	

* - Denotes VOC not detected in Phase 3 borings but detected in on-Site Fill Unit in previous Phase 1 or 2 investigations

Table does not include potential or estimated. VOC conc. ("ND"or "J" values) that could exceed MDEQ criteria

— Chemical constituent not detected in any Phase 3 soil sample analytical results

On-Site Fill Unit - Subsurface Soil VOC and SVOC Criteria Exceedances: Two soil samples were collected from the on-Site Fill Unit one of which contained VOCs and SVOCs above MDEQ criteria. As identified in the table above and as shown on Figure 6.1, the VOC and SVOC soil sample analytical results from on-Site soil boring SB-52 identified 5 VOC and 10 SVOC constituents above MDEQ criteria. Soil boring SB-52 is located near the Diked Lagoon adjacent to the west side of the former Rouge River. Figure 6.1 also shows that each of the 5 VOCs detected at SB-52 plus two other VOC constituents (i.e., styrene and toluene) were detected above MDEQ criteria at on-Site borings completed on the west side of the former Rouge River during the Phase 1 or 2 investigations. Figure 1.2 shows that the fill soils encountered at SB-52 were likely excavated from the former 22-acre Gas Plant property during the construction of the Primary Lagoon (U.S. Army Corps, 1974). The presence of VOC and SVOC soil exceedances at SB-52 is consistent with the presence of VOC and SVOC groundwater exceedances at MW-52D (see Section 7.0). The analytical results for on-Site soil boring SB-51, located near the Diked Lagoon adjacent to the east side of the former Rouge River, did not detect any VOCs or SVOCs above MDEQ criteria.

Off-Site Fill Unit - Subsurface Soil VOC and SVOC Criteria Exceedances: Three of the 11 soil samples collected from the off-Site Fill Unit contained VOC and SVOC concentrations above MDEQ criteria. These three samples were collected from soil borings SB-61 and SB-62 (two samples were analyzed from SB-62). These two borings are located off-Site near the sludge ponds. As shown on Figure 6.2, the three Fill Unit samples from SB-61 and SB-62 and the four soil samples from the Clayey Sand Unit at off-Site soil borings SB-66, SB-67, SB-68, and SB-69, were the only off-Site locations where VOC and/or SVOC concentrations exceeded MDEQ criteria. Figure 1.2 shows soil borings SB-61 and SB-62 were likely located in fill materials deposited by the U.S. Army Corps during the construction of the new Rouge River channel. As shown in the table above, with exception of styrene and toluene, the VOCs detected in the off-Site Fill are similar to the VOCs detected in off-Site native soils (i.e., the Clayey Sand Unit) and on-Site Fill soils (i.e., fill soils west of the former Rouge River). These chemical similarities suggest the VOCs and SVOCs may be from the same source. The absence of VOC and SVOC soil exceedances in the Fill Unit at soil borings SB-70, SB-71 and SB-72 and the presence of VOC and SVOC groundwater exceedances at monitoring wells MW-70D, MW-71D and MW-72 indicates VOCs and SVOCs are migrating laterally in groundwater and not vertically downward through the soils at these locations (see Section 7.0).

Off-Site Clayey Sand Unit - VOC and SVOC Criteria Exceedances: Four of the 8 soil samples collected from the off-Site Clayey Sand Unit contained VOC and SVOC concentrations

above MDEQ criteria. These four samples are from soil borings SB-66, SB-67, SB-68, and SB-69, which are located adjacent to the new Rouge River channel between pressure relief vents PRV-3E and PRV-5E. As shown in the table above, the VOCs and SVOCs detected in this off-Site native soil were similar to those detected in the on-Site Fill Unit. As shown in Figure 6.2, the 200 ppm concentration of total xylenes at SB-66 and the 230 ppm concentration of ethylbenzene at SB-68 exceeded all the following MDEQ criteria: DWP, GSIP, GWCP, SVIIC, DCC, and Csat. These four soil borings are located within or directly adjacent to the surface impoundment's operated by former gas plant. The VOC and SVOC exceedances detected in native soils that were directly below or adjacent to a hydrocarbon source area (i.e., the portion of the surface impoundment's that were excavated to construct the new channel) suggest they are related to former manufactured gas plant operations. The presence of the VOC and SVOC soil exceedances at borings SB-66, SB-67, SB-68, and SB-69 is consistent with the presence of VOC and SVOC groundwater exceedances detected at monitoring wells installed at the same location (i.e., MW-66D, MW-67D, MW-68D1, MW-68D2, and MW-69Dand the VOC and SVOC exceedances detected in pressure relief vents adjacent to the borings (i.e., PRV-3 and PRV-4). The soil analytical data indicate the lateral extent of VOC and SVOC exceedances encompasses on-Site and off-Site areas between the former Rouge River and the current Rouge River.

Off-Site Sand/Sand and Gravel Unit - VOC and SVOC Criteria Exceedances: The single soil sample collected from the Sand and Gravel Unit did not contain any VOCs or SVOCs above MDEQ criteria (Table 6.1 and Figure 6.2). The sample was collected in the unsaturated sand encountered in soil boring SB-65, which was located adjacent to the Rouge River approximately half way between pressure relief vents PRV-2E and PRV-3E. The absence of VOC and SVOC soil exceedances at boring SB-65 is consistent with the absence of VOC and SVOC groundwater exceedances at monitoring well installed at the same location (i.e., MW-65D).

Off-Site and On-Site Silty Clay Unit - VOC and SVOC Criteria Exceedances: None of the 12 soil samples collected from the Silty Clay Unit contained VOC or SVOC concentrations above the MDEQ criteria (Tables 6.1 and 6.2, Figures 6.1 and Figure 6.2). These soil samples were collected from on-Site borings completed adjacent to the former Rouge River (SB-51) and off-Site borings completed on adjacent properties to the north, east and west of the Site. The absence of VOC exceedances in the Silty Clay Unit indicates this low permeability deposit is retarding vertical migration of the VOC and SVOC constituents.

6.2 PCB SOIL SAMPLE ANALYTICAL RESULTS

The PCB soil sample analytical results are presented in Table 6.3. As shown in the exceedances table below, no PCBs were detected in the Phase 3 investigation. The PCBs detected during the Phase 1 or 2 investigation in on-Site soils in concentrations that exceed MDEQ criteria are presented in Figure 6.1 (both 11"x 17" and 24"x 36"). The table below summarizes the PCB constituents that exceeded MDEQ criteria by geologic unit. A description of the PCB detections and exceedances are presented below.

PCB EXCEEDANCES IN SOIL BY GEOLOGIC UNIT

# of PCBs	Fill Unit (On-Site) PCB Exceedances	Fill Unit (Off-Site) PCB Exceedances	Sandy Clay (Off-Site) PCB Exceedances	Silty Clay (Off-Site) PCB Exceedances
1.	Aroclor 1260 *	No	No	No
		PCBs were	PCBs were	PCBs
		Detected above	Detected above	were
		Report Limits	Report Limits	Detected

* - Denotes PCB not detected in Phase 3 borings but detected in on-Site Fill Unit in previous Phase 1 or 2 investigations

Table does not include potential or estimated VOC concentrations ("ND" or "J" values) that could exceed MDEQ criteria

On-Site Fill Unit - Subsurface Soil PCB Detections: Neither of the two soil samples collected from the on-Site Fill Unit contained PCB concentrations above the MDEQ criteria. The fill sample from soil boring SB-51 did contain estimated PCB concentrations less than the MDEQ criteria of 1.0 ppm (i.e., Aroclor 1248 at 0.14J ppm and Aroclor 1260 at 0.064J ppm). During the Phase 1 and 2 investigations, only two fill samples containing PCBs above 1.0 ppm were identified (Aroclor 1260 concentrations of 1.0 and 3.1/5.9 at soil borings SB-1 and SB-40, respectively). The data is consistent with the absence of any known leaks or releases from a former PCB-containing transformer at the Site.

Off-Site Fill Unit - Subsurface Soil PCB Detections None of the 11 soil samples collected from the off-Site Fill Unit contained PCB concentrations above MDEQ criteria. All the PCB concentrations identified were quantified with a "J" value, which denotes that the analyte was positively identified but the concentration reported is an estimated numerical value (typically below reporting limits).

Clayey Sand Unit - PCB Criteria Exceedances: None of the eight soil samples collected from the off-Site Clayey Sand Unit contained PCBs above the MDEQ criteria. All PCBs detected were estimated values below the laboratory report limit (Table 6.3 and Figure 6.2).

Sand and Gravel Unit - PCB Criteria Exceedances: No PCB Aroclors were detected above their respective laboratory detection limit (Table 6.3) in the sample collected from the Sand and Gravel Unit.

Silty Clay Unit - PCB Criteria Exceedances: No PCB Aroclors were detected above their respective laboratory detection limit (Table 6.3) in the 10 samples analyzed from the Silty Clay Unit.

6.3 METAL SOIL SAMPLE ANALYTICAL RESULTS

The metal soil sample analytical results are presented in Table 6.4. The metals detected during the Phase 1, 2, or 3 in on-Site soils in concentrations that exceed MDEQ criteria are presented in Figure 6.1 (both 11"x17" and 24"x36"). The metals detected in the Phase 3 in off-Site soils in concentrations that exceed MDEQ criteria are summarized in Figures 6.1 and 6.4. Figure 6.1 summarizes the on-Site exceedances and Figure 6.2. The table below summarizes the metal constituents that exceeded MDEQ criteria by geologic unit. A description of the metal exceedances are presented below.

METAL EXCEEDANCES IN SOIL BY GEOLOGIC UNIT

# of Metals	Fill Unit (On-Site) Metals Exceedances	Fill Unit (Off-Site) Metals Exceedances	Sandy Clay (Off-Site) Metals Exceedances	Silty Clay (Off-Site) Metals Exceedances
1.	Aluminum *	---	---	No
2.	Antimony *	---	---	Metals
3.	Arsenic	---	---	Exceeded
4.	Chromium (Cr^{+3})	Chromium (Cr^{+3})	---	Criteria
5.	Copper *	---	---	
6.	Cyanide (Available)	Cyanide (Available)	Cyanide (Available)	
7.	Cobalt *	Cobalt	---	

8.	Iron	Iron	---	
9.	Lead *	---	---	
10.	Magnesium *	---	---	
11.	Manganese *	Manganese	---	
12.	Mercury	Mercury	Mercury	
13.	Nickel *	Nickel	---	
14.	Selenium	Selenium	---	
15.	Silver *	Silver	---	
16.	Zinc *	---	---	

* - Denotes metal not detected in Phase 3 borings but detected in on-Site Fill Unit in previous Phase 1 or 2 investigations

Table does not include potential or estimated VOC concentrations ("ND" or "J" values) that could exceed MDEQ criteria

On-Site Fill Unit - Subsurface Soil Metal Criteria Exceedances: The two soil samples collected from the on-Site Fill Unit contained metal concentrations above MDEQ criteria (Table 6.4). As shown on Figure 6.1, the analytical results for on-Site soil borings SB-51 and SB-52 identified up to six metals above the MDEQ criteria (i.e., arsenic, chromium +3, available cyanide, iron, mercury and selenium). Figure 6.1 also shows that each of the six metals detected at SB-51 or SB-52 plus 10 other metals were detected above MDEQ criteria at on-Site borings during the Phase 1 or 2 investigations. The Figure shows that the majority of surface soils contain manganese and chromium above the MDEQ particulate soil inhalation criteria (PSIC) and/or lead above the MDEQ direct contact criteria (DCC). The PSIC and direct contact exceedances are presented in Figure 8.1. As indicated to the MDEQ in previous meetings and correspondence, the remedial action for the surface soil PSIC exceedances will be assessed after the Rouge Manufacturing Complex site-specific PSIC application is reviewed and approved by the MDEQ. The remedial action for the existing DCC exceedances includes barricading the perimeter of the area and posting appropriate signage to eliminate the exposure pathway.

Off-Site Fill Unit - Subsurface Soil Metal Criteria Exceedances: Three of the 8 soil samples collected from the off-Site Clayey Sand Unit contained metal concentrations above MDEQ criteria (Table 6.4). These three samples are from soil borings SB-59, SB-66, and SB-71, which are located adjacent to the new Rouge River channel near PRV-1E, PRV-3E, and the secondary lagoon outfall, respectively (Figure 6.2).

Off-Site Sand/Sand and Gravel Unit - Metal Criteria Exceedancess: The single soil sample collected from the Sand and Gravel Unit did not contain any metals above MDEQ

criteria (Table 6.4 and Figure 6.2). The sample was collected in the unsaturated sand encountered in soil boring SB-65, which was located adjacent to the Rouge River approximately half way between pressure relief vents PRV-2E and PRV-3E.

Off-Site and On-Site Silty Clay Unit – Metal Criteria Exceedances: No metals were detected above MDEQ criteria (Table 6.4) in the 12 samples analyzed from the Silty Clay Unit.

7.0 GROUNDWATER AND SURFACE WATER INVESTIGATION RESULTS

The following sections of the report summarize groundwater sample analytical results from the Phase 3 remedial investigation. Additionally, groundwater sample analytical results from the IRA are also presented. Collectively, the analytical data includes results from:

- 16 semi-confined wells installed during the Phase 3 investigation;
- 10 unconfined wells installed during the Phase 3 investigation; and
- 5 semi-confined wells installed during the Phase 2 and resampled during the IRA.

Of the 26 groundwater samples submitted for analysis during the Phase 3 investigation, all but four (i.e., groundwater samples from MW-51S, MW-51D, MW-52S and MW-52D) were collected from adjacent off-Site properties. All groundwater samples submitted to the laboratory were analyzed for VOCs, SVOCs, PCBs, and/or metals in accordance with methods identified in the Work Plan. The groundwater analytical results were validated in accordance with the procedures outlined in the QAPP. All sample delivery groups (SDGs) containing sample data collected from the Site were assessed for compliance with method guidelines and project-specific requirements. All data qualifiers identified during the data validation activities have been incorporated into the analytical results presented in Tables 7.1 (VOCs), 7.2 (SVOCs), 7.3 (PCBs), and 7.4 (metals).

The analytical results for the organic constituents (VOCs, SVOCs, and PCBs) and the inorganic constituents (metals) detected in the on-Site groundwater samples is also summarized on Figure 7.1 (which are presented on 11"x17" and "D"-sized figures). Off-Site groundwater sample analytical results are summarized on Figure 7.2 both 11"x17" and "D"-sized figures). Each databox figure presents a summary of constituents that exceed the January 2006 residential, commercial or industrial groundwater criteria. Each databox figure also includes a total constituent value (i.e., Total VOC, Total SVOC, etc.) to provide an overview of the distribution of impacts at the Site.

The validated results were compared to Table 1, *"Groundwater Residential and Industrial-Commercial Part 201 Generic Cleanup Criteria and Screening Levels"* as presented in RRD Operational Memorandum No.1, dated January 23, 2006. This criteria is summarized in Table 7.5. Data validation memoranda are presented in Appendix G. A copy of the groundwater sample analytical results is included on the CD presented in Appendix H.

The remainder of this Section summarizes the groundwater analytical data and screens the data against the generic groundwater cleanup criteria presented in Table 7.5. Additionally, as shown on Tables 7.1 through 7.4, some groundwater sample report limits and method detection limits were elevated due to interference and are reported at limits required to successfully analyze the samples. Review of the limits for the non-detect results indicate that some of the data was reported as non-detect at a detection limit greater than MDEQ criteria. Therefore, although specific VOCs, SVOCs, PCBs, or Metals were "not detected" and shown as an "ND", the result was boxed on the analytical summary tables as a potential exceedance. The chemical constituents associated with these potential "ND" exceedances are not discussed in any of the following sections but are identified in the tables.

# of Wells	Unconfined Zone (On-Site)	Semi-confined Zone (On-Site)	Semiconfined Zone (Off-Site)	Pressure Relief Vents (Off-Site)
1.	MW-2S	MW-51D	MW-59D	PRV-1W
2.	MW-14S	MW-52D	MW-60D	PRV-2W
3.	MW-21S		MW-61D	PRV-3W
4.	MW-34S		MW-62D	PRV-4W
5.	MW-36S		MW-63D	PRV-5W #
6.	MW-38S		MW-64D	PRV-6W
7.	MW-39S		MW-65D	PRV-7W
8.	MW-41S		MW-66D	
9.	MW-51S		MW-67D	
10.	MW-52S		MW-68D1	
11.			MW-68D2 *	
12.			MW-69D	
13.			MW-70D	
14.			MW-71D	
15.			MW-72D	

* - Denotes groundwater sample not collected due to the presence of DNAPL.

- Denotes water sample could not be collected due to the vaultbox being filled with debris

7.1 VOC AND SVOC GROUNDWATER CRITERIA EXCEEDANCES

The VOC and SVOC groundwater sample analytical results are presented in Tables 7.1 and 7.2 respectively. The on-Site VOC and SVOC constituents detected during the Phase 1, 2, or 3 investigations that exceed MDEQ criteria are summarized on Figures 7.1 and the off-Site VOC and SVOC exceedances are summarized on Figure 7.2. The table below summarizes the VOC and SVOC constituents that exceeded MDEQ criteria by saturated zone. A description of the VOC and SVOC exceedances are presented below.

# of VOCs & SVOCs	Unconfined Zone (On-Site) VOC & SVOC Exceedances	Semi-confined Zone (On-Site) VOC & SVOC Exceedances	Semi-confined Zone (Off-Site) VOC & SVOC Exceedances	PRV (Off-Site) VOC & SVOC Exceedances
VOCs				
1.	1,2,4-TMB	1,2,4-TMB	1,2,4-TMB	1,2,4-TMB
2.	Benzene	Benzene	Benzene	Benzene
3.	Ethylbenzene	Ethylbenzene	Ethylbenzene	Ethylbenzene
4.	Toluene	Toluene	Toluene	Toluene
5.	Xylenes	Xylenes	Xylene	Xylenes
6.	----	----	c-1,2-dichloroethene	----
SVOCs				
1.	----	2-Methylnaphthalene	2-Methylnaphthalene	----
2.	Acenaphthene	Acenaphthene	Acenaphthene	Acenaphthene
3.	----	Acenaphthylene *	----	----
4.	----	Anthracene *	----	----
5.	----	Benzo(a)anthracene *	----	----
6.		Benzo(a)pyrene *	----	----
7.	----	Benzo(b)fluoranthene *	----	----
8.	----	Benzo(g,h,I)perylene *	----	----
9.	----	Benzo(k)fluoranthene *	----	----
10.	Carbazole	----	Carbazole	----
11.	----	Chrysene *	----	----
12.	Dibenzofuran	----	----	----
13.	Fluoranthene	Fluoranthene *	----	Fluoranthene
14.	Fluorene	Fluorene	Fluorene	----
15.	----	Indeno(1,2,3-cd)pyrene *	----	----
16.	Naphthalene	Naphthalene	Naphthalene	Naphthalene

17.	----	----	Pentachlorophenol	----
18.	Phenanthrene	Phenanthrene	Phenanthrene	Phenanthrene
19.	----	Phenol *	Phenol	----
20.	----	Pyrene *	----	----
21.	----	Pyridene *	----	----

* - Denotes SVOC was not detected in Phase 3 sampling but was detected in on-Site wells in Phase 1 or 2 investigations

Table does not include potential or est. VOC or SVOC conc. ("ND"or "J" values) that could exceed MDEQ criteria

— Chemical constituent not detected in any Phase 1,2,or 3 groundwater sample analytical results

On-Site Unconfined Monitoring Wells – VOC and SVOC Criteria Exceedances: Seven of the 10 groundwater samples collected from the on-Site wells installed in the Unconfined Zone contained up to 5 VOCs and 7 SVOCs in concentrations above MDEQ criteria. The highest concentrations were detected at MW-14S and MW-52S, which are located in the west central portion of the Site west of the abandoned Rouge River channel (i.e., along the western property boundary and near the southeast corner of the Diked Lagoon, respectively). Figure 7.1 shows that the same 5 VOCs and 7 SVOCs detected in the Unconfined Zone were also identified in the Semi-confined Zone in concentrations that exceeded MDEQ criteria. Although similar constituents were detected in the both zones, the concentrations in the Unconfined Zone were typically at least 1 to 4 orders of magnitude less than those identified in the Semi-confined Zone. As shown on Figure 7.1, the VOC and SVOC exceedances in the Unconfined Zone were for DW and GSI criteria only.

On-Site Semi-Confined Monitoring Wells – VOC and SVOC Criteria Exceedances: Both of the on-Site semi-confined wells sampled during the Phase 3 (MW-51D and MW-52D) contained up to 5 VOCs and 5 SVOCs in concentrations above MDEQ criteria. Figure 7.1 also shows that these same constituents plus 13 additional SVOCs were detected above MDEQ criteria in previous investigations of the Semi-confined Zone. The highest historic VOC and SVOC concentrations were detected at MW-4D, MW-11D, MW-14D, MW-38D, and MW-47D, which are all located within or west of the abandoned Rouge River channel. As shown on Figure 7.1, the VOC and SVOC exceedances in the Semi-confined Zone were typically for DW and GSI criteria. However, the naphthalene and/or benzene concentrations at MW-4D, MW-11D, MW-14D, MW-38D and MW-47D also exceeded Groundwater Volatilization to Indoor Air Inhalation (GWVIIC), Groundwater Contact (GWC), Flammability & Explosivity Screening Levels, and Acute Inhalation Screening Levels.

During the IRA activities, each of these five wells were re-sampled to confirm the MDEQ exceedances. As shown in Figure 7.1, groundwater analytical results from two of these five wells (MW-38D and MW-47D) showed benzene concentrations meet or exceed the acute inhalation criteria of 67 ppm (qualifier "i" in the figure) and the flammability and explosivity screening level criteria of 68 ppm (qualifier "h" in the figure). The figure also shows that one well (MW-14D) contains naphthalene concentrations that exceeds the acute inhalation criteria of 31 ppm (qualifier "i" in the figure). The IRA groundwater sampling activities also showed that the benzene and/or naphthalene concentrations detected in monitoring wells MW-04D and MW-11D were not above either screening criteria.

As shown in the table on Page 43 and 44, the number of SVOC exceedances in the on-Site Semi-confined Zone is at least twice the exceedances detected in the other zones. The greater number of SVOC exceedances detected in the Semi-confined Zone combined with the greater concentrations of the VOCs and SVOCs identified in the Semi-confined Zone (plus the locations where the exceedances were identified), indicate the source of hydrocarbons is west of the former Rouge River. This source area designation is supported by the data presented in Table 7.6, which shows that over 95 percent of the hydrocarbon mass is located within and west of the former Rouge River channel.

Off-Site Semi-Confined Monitoring Wells – VOC and SVOC Criteria Exceedances: nine of the 14 groundwater samples collected from the off-Site wells installed in the off-Site Semi-confined Zone contained up to 5 VOCs and 8 SVOCs in concentrations above MDEQ criteria. The highest concentrations were detected at MW-66D, MW-67D, MW-68D1, MW-68D2 and MW-69D. These five monitoring wells are located on Wayne County property adjacent to the Rouge River between pressure relief vents PRV-3E and PRV-4E. The area encompassed by these five wells corresponds to the former tar pond and surface impoundment's operated by the former Gas Plant and contains VOCs and SVOCs in soils in concentrations above MDEQ criteria. Additionally, free phase DNAPL was detected at well MW-68D2, which is located adjacent to MW-68D1. Figure 7.2 shows that the same 5 VOCs and 8 SVOCs that exceeded MDEQ criteria in the Semi-confined Zone on the Wayne County property were also identified in the Semi-confined Zone at the Site in concentrations that exceeded MDEQ criteria. Additionally, based on: (1) the high VOC and SVOC concentrations identified in the DNAPL detected at MW-68D2; (2) the concentration of c-1,2-dichloroethene detected at MW-66D that exceeded MDEQ criteria; and (3) the concentration of pentachlorophenol detected at MW-72D that exceeded MDEQ criteria, it appears the Wayne County property contains commingled VOC and SVOC constituents from different sources (i.e., wells MW-66D and MW-72D

are the only locations where the chlorinated solvent and the biocide/wood preservative were identified). Based on the current data set, it could not be determined if these compounds could be attributable to the former Melvindale Dump area.

Figure 7.2 shows the VOC and SVOC concentrations detected in off-Site wells on the Wayne County property exceeded the generic final acute values (FAVs) from Rule 57 of the Part 4 rules for Part 31 of Public Act 451 (qualifier "j" in the figure). Based on the VOC and SVOC exceedances and the proximity of the off-Site monitoring well locations to the adjacent Rouge River, an FAV Exceedance Notification letter was submitted to the MDEQ on December 22, 2006 by CRA on behalf of Ford and SNA. A copy of the notification letter is presented in Appendix I.

Eastern Pressure Relief Vents – VOC and SVOC Criteria Exceedances: As part of the IRA, each of the 5 PRVs located on the east side of the Rouge River (PRV-1E through PRV-5E) were re-sampled to confirm exceedances identified in previous investigations. The analytical results indicated that up to 5 VOCs and 4 SVOCs were detected in concentrations above MDEQ criteria. As shown in the exceedance summary on page38, each of these VOC and SVOC constituents identified in the PRVs were also detected in groundwater at and adjacent to the Site in concentrations that also exceeded MDEQ criteria. The highest VOC and SVOC concentrations were detected at PRV-3E and PRV-4E, which are located in areas near the former tar pond and surface impoundment's operated by the former Gas Plant. Pressure relief vent PRV-4E is also located within 5 feet of monitoring well MW-68D2, which contains DNAPL. As shown in Figure 7.2, the benzene concentration of 33 ppm at PRV-4E was the highest concentration detected in the PRVs. It exceeded the benzene default GSI criteria of 0.012 ppm, a value considered to be protective of human drinking water that is applied to waters of the Great Lakes and connecting waterways (compared to a benzene generic GSI criteria of 0.2 ppm). Based VOCs and SVOC exceedances detected in native soils in the area, and the upward hydraulic pressure observed in the Phase 3 monitoring wells installed adjacent to the river, the water quality observed in the pressure relief vents on the east side of the river is believed to represent water quality of both the Unconfined Zone and Semi-confined Zone.

Figure 7.2 also shows concentrations of benzene, toluene, ethylbenzene, xylenes and naphthalene detected in the drain tile at PRV-3E and PRV-4E are above the generic final acute values. However, since the subdrain does not conform with MDEQ-approved GSI monitoring point construction standards, these PRV analytical results were not

considered representative (therefore the Phase 3 monitoring wells were installed and sampled to assess compliance with applicable regulations).

Western Pressure Relief Vents – VOC and SVOC Criteria Exceedances: As part of the Phase 3, six of the seven pressure relief vents located on the west side of the Rouge River (PRV-1W through PRV-7W) were sampled to assess water quality discharging to the Rouge River. Pressure relief vent PRV-5W was not accessible due to the debris that filled the chamber and therefore was not sampled. Of the six PRVs sampled, the analytical results indicate that 2 VOCs and 1 SVOC were detected in concentrations above MDEQ criteria. Figure 7.2 shows that benzene levels above default GSI criteria of 0.012 ppm were detected at PRV-3W, PRV-4W, PRV-6W, and PRV-7W. The highest VOC and SVOC concentrations were detected at PRV-4W, which is located within the former surface impoundment area operated by the former gas plant.

7.2 PCB GROUNDWATER CRITERIA EXCEEDANCES

Unconfined Monitoring Wells – PCB Criteria Exceedances: During the Phase 3 investigation, PCBs were detected in groundwater samples from unconfined wells MW-2S (0.00019 ppm) and MW-41S (0.00009 ppm). Neither detection resulted in an exceedance of any applicable MDEQ Part 201 cleanup criteria (Table 7.3 and Figure 7.1). During the Phase 1 and 2 investigations, PCBs were detected in one groundwater sample from unconfined well MW-16S. These three wells are all located in the former Rouge River channel.

On-Site Semi-Confined Monitoring Wells – PCB Criteria Exceedances: During the Phase 3 investigation, PCBs were not detected at semi-confined wells MW-51D or MW-52D (Table 7.3 and Figure 7.1). During the Phase 1 and 2 investigations, PCBs were detected in Semi-confined wells MW-4D and MW-14D. Both of these wells formerly and currently contain DNAPL.

Off-Site Semi-Confined Monitoring Wells – PCB Criteria Exceedances: Total PCBs were detected in two groundwater samples from MW-59D (0.000075 J ppm) and MW-65D (0.000096 J ppm). These results do not exceed any applicable MDEQ Part 201 cleanup criteria (Table 7.3 and Figure 7.2).

Eastern Pressure Relief Vents – PCB Criteria Exceedances: PCBs were not identified in any of the groundwater samples collected from the 5 PRVs on the eastern side of the Rouge River (Table 7.3 and Figure 7.2).

Western Pressure Relief Vents – PCB Criteria Exceedances: PCBs were not identified in any of the groundwater samples collected from the 6 PRVs on the western side of the Rouge River (Table 7.3 and Figure 7.2).

7.3 DISSOLVED AND TOTAL METAL CRITERIA EXCEEDANCES

Unconfined Monitoring Wells – Metal Criteria Exceeadances: Five of the 10 groundwater samples collected from the unconfined wells identified metal concentrations above MDEQ generic GSI criteria. Thirteen different metals exceeded MDEQ GSI criteria, including antimony, arsenic, cadmium, chromium, cobalt, copper, available cyanide, lead, manganese, nickel, selenium, silver, and vanadium. A review of the dissolved and total analyses conducted for each metal showed the detections were predominately in the dissolved phase. The largest number of exceedances and the highest concentrations of metal exceedances were typically identified in the unconfined wells completed in the former Rouge River Channel (i.e., MW-21S, MW-41S, and MW-51S) that had been backfilled after the Army Corps completed their flood control project.

On-Site Semi-Confined Monitoring Wells – Metal Criteria Exceedances: The two groundwater samples collected from on-Site wells completed in the Semi-confined Zone (MW-51D and MW-52D) identified up to seven metals in concentrations above the MDEQ GSI criteria. These included antimony, chromium, cobalt, copper, available cyanide, selenium and silver, and vanadium. A review of the dissolved and total analyses conducted for each metal showed the detections were predominately in the dissolved phase.

Off-Site Semi-Confined Monitoring Wells – Metal Criteria Exceedances: Nine of the 15 groundwater samples collected from the semi-confined wells identified metal concentrations above MDEQ generic GSI criteria. Thirteen different metals exceeded MDEQ GSI criteria, including antimony, arsenic, cadmium, chromium, cobalt, copper, available cyanide, lead, manganese, nickel, selenium, silver, and vanadium. A review of the dissolved and total analyses conducted for each metal showed the detections were predominately in the dissolved phase.

Eastern Pressure Relief Vents – Metal Criteria Exceedances: Three of the 5 water samples collected from the eastern pressure relief vents during the Phase 2 or Interim Response Actions identified metal concentrations above MDEQ generic GSI criteria. Three

different metals exceeded MDEQ GSI criteria, including available cyanide, manganese, and lead. These GSI exceedances were detected in PRV-1E, PRV-3E and PRV-4E (Figure 7.2). A review of the dissolved and total analyses conducted for each metal showed the detections were predominately in the dissolved phase.

Western Pressure Relief Vents – Metal Criteria Exceedances: Two of the 6 water samples collected from the western pressure relief vents during the Phase 3 investigation identified metal concentrations above MDEQ generic GSI criteria. Two different metals exceeded MDEQ GSI criteria, including available cyanide and chromium. These GSI exceedances were detected in PRV-3W and PRV-4W (Figure 7.2). A review of the dissolved and total analyses conducted for each metal showed the detections were predominately in the dissolved phase.

7.4 SURFACE WATER INVESTIGATION RESULTS

The May 12, 2006 Rouge River surface water samples (SW-1, SW-2, and SW-3) were collected at locations upgradient of PRV-1E, near PRV-3E and downgradient of PRV-5E (Figure 2.2). The results of the surface water samples are presented in Table 7.7. The analytical results indicate one VOC (benzene) was detected at SW-2 and SW-3 at concentrations above the laboratory reporting limit. Two other VOCs (ethylbenzene and toluene) and three other SVOCs (fluoranthene, naphthalene, and pyrene) were detected in the surface water samples at estimated values. The analytical results also indicate that hexavalent chromium was detected in one sample (SW-2) at a concentration above laboratory reporting limits and that manganese was detected in estimated concentrations below the laboratory report limit in all three surface water samples. Ammonia was not detected in any of the samples at concentrations above the laboratory report limit of 0.200 ppm. However, the report limit for ammonia was above its Part 31 Rule 57 warm water Final Chronic Value of 0.053 ppm. The ammonia sample results could not be compared to the laboratory method detection limits, which were below the Final Chronic Value, due to laboratory contaminant detected in the method blank. During the Phase 2 investigation, ammonia analyses were conducted on groundwater samples from select monitoring locations on or adjacent to the Site. These sample locations and ammonia results included MW-14D (18 ppm), MW-16D (7.2 ppm), MW-25D (22 ppm), MW-39D (6.1 ppm), MW-49 (10 ppm), and PRV-2E (4.5 ppm).

8.0 PART 201 PATHWAY ANALYSIS

Applicable soil and groundwater pathway analyses are presented below.

8.1 SOIL

The Part 201 Criteria that were used to evaluate soil sample results from the Site can be considered in the context of three pathway categories, Inhalation, Direct Contact, and Groundwater Protection. A fourth category, Soil Saturation Screening Level, is also relevant to an evaluation of Site data due to the presence of free product. The significance of exceedances associated with each pathway is described in this Section.

8.1.1 SOIL INHALATION

The Ambient Air Inhalation Criteria were exceeded in 4 of 36 Phase 3 soil samples. These include SB-52 (7.5-10.0), SB-62 (12.0-14.0), SB-66 (3.0-5.0), and SB-68 (2.5-5.0). All three locations exceeded one or more of the following ambient air criteria;

- Soil Volatilization Indoor Air Inhalation;
- Infinite Source Volatile Soil Inhalation;
- Finite Source Soil Inhalation - 5M Source Thickness;
- Finite Source Soil Inhalation -2M Source Thickness; and
- Particulate Soil Inhalation.

The samples from SB-52 and SB-62 are from the Fill Unit, while the other two samples are from the Clayey Sand/Silty Sand Unit. Three of the four locations are located off-Site between the Site and the Rouge River (i.e., SB-62, SB-66, and SB-68), while SB-52 is located off the southeast corner of the Diked Lagoon. Since these exceedances are identified at isolated locations that are less than 5 meters thick, their presence will be recognized when considering potential response activities.

The sample from SB-62 is the only Phase 3 soil sample to exceed Particulate Soil Inhalation Criteria (total chromium and manganese only). Based on a review of the soil sample analytical data from the Phase 1, 2 and 3 investigations, manganese is the predominant constituent that exceeds particulate soil inhalation criteria (PSIC). Figure 8.1 shows a summary of the surface soil inhalation exceedances identified during the investigations and Figure 8.2 shows a summary of subsurface soil inhalation

exceedances (i.e., qualifier "j" in the figures). Additional evaluation of this soil inhalation pathway will be conducted after the same issues at the Rouge Manufacturing Complex are evaluated and approved by the MDEQ.

8.1.2 SOIL DIRECT CONTACT

Direct Contact Criteria for the Industrial/Commercial II, III, and IV generic exposures were exceeded in 3 of 36 Phase 3 samples (1 subsurface fill and 2 clayey sand/silty sand samples). These exceedances were identified at SB-52 (on-Site) and SB-66 and SB-68 (off-Site) and included one or more of the following compounds: ethylbenzene, total xylenes, and/or benzo(a)pyrene. Figures 8.1 and 8.2 shows the soil direct contact exceedances identified in surface and subsurface soils during the Phase 1, 2, and 3 investigations. The exceedances of Direct Contact Criteria will be considered in a Feasibility Study/Remedial Alternatives evaluation.

8.1.3 SOIL PROTECTION OF GROUNDWATER CRITERIA

The Protection of Groundwater Criteria includes Residential Drinking Water Protection, Industrial/Commercial Drinking Water Protection and Groundwater/Surface Water Interface Protection Criteria. Two of these criteria relate to protection of drinking water, which must come from an aquifer, and the third relates to protection of groundwater that is about to enter a surface water.

The Phase 3 identified widespread exceedances of Drinking Water Protection and Groundwater/Surface Water Protection Criteria. Exceedances occur in two subsurface units (i.e., Fill Unit and Clayey Sand Unit).

Exceedances of soil protection of groundwater were identified throughout the Site during the Phase 1 and 2 investigations. At least one VOC, SVOC, or metal constituent exceeded the groundwater protection criteria in very boring completed at the Site. Exceedance of these criteria will be considered in a Feasibility Study.

8.1.4 SOIL SATURATION CONCENTRATION SCREENING LEVELS

Soil saturation screening levels were exceeded in two samples from the Clayey Sand/Silty Sand Unit (SB-66 and SB-68), both of which were identified in soil borings containing residual phase product and/or DNAPL (i.e., MW-68D2 only). Figure 8.2 shows the exceedances of soil saturation screening criteria identified in the Phase 1, 2, and 3 investigations (i.e., qualifier "n" in the figure). An exceedance of this criteria does not independently prompt a response to this condition.

8.2 GROUNDWATER

The Part 201 Criteria that were used to evaluate groundwater sample results from the Schaefer Road Site are listed below. The significance of exceedances associated with each pathway is described in this Section.

8.2.1 DRINKING WATER CRITERIA

Residential & Commercial I and the Industrial & Commercial II, III, IV Drinking Water criteria were exceeded in all 37 groundwater samples collected during the Phase 3 from monitoring wells and PRVs. At least one VOC, SVOC or metal constituent from the wells sampled in the Phase 1 and 2 investigations exceeded the drinking water criteria. The significance of the drinking water exceedances depends on whether or not the saturated zones identified at the Site can be classified as an aquifer. Data presented in this report indicates that groundwater at this Site could be considered a useable aquifer if the determination is based solely on current formation yields. However, these yields appear to be influenced by potential leakage from the Primary and/or Secondary Lagoons, which could be modified in the future

8.2.2 GROUNDWATER SURFACE WATER INTERFACE CRITERIA

GSI criteria was exceeded in all 28 Phase 3 monitoring well locations and 4 of the 6 PRVs on the western side of the river. The majority of Phase 1 and 2 monitoring well or PR groundwater samples also exceeded the criteria. Additionally, exceedances of generic GSI criteria based on acute toxicity (FAV) were identified. These exceedances will be considered in a Feasibility Study/Remedial Alternatives evaluation.

8.2.3 GROUNDWATER VOLATIZATION TO INDOOR AIR CRITERIA

Residential and Commercial I GWVIIC were exceeded in 5 of 28 Phase 3 monitoring wells (MW-52D, MW-67D, MW-68D1, MW-69D, and MW-70D). Industrial and Commercial II, III, & IV GWVIIC were exceeded in 2 of the 28 monitoring wells (MW-67D and MW-68D1). These wells are located off-Site or in remote areas of the Site (i.e., MW-52D) and therefore the criteria is not applicable unless future land use in the immediate area involves new building construction. Figure 8.3 shows the exceedances of generic GWVIIC criteria identified in the Phase 1, 2, and 3 investigations (i.e., qualifiers "e" in the figure). These exceedances will be considered in a Feasibility Study/Remedial Alternatives evaluation.

8.2.4 GROUNDWATER CONTACT CRITERIA

Groundwater contact criteria was exceeded in 3 of the 28 Phase 3 monitoring wells (MW-52D, MW-67D, and MW-68D1) for benzene only. Groundwater encountered at these locations was under semi-confined conditions with depth to water ranging from 6 to 13 feet below grade, which is within depths typically used when considering construction worker exposure pathways. Figure 8.3 shows the exceedances of the groundwater contact identified in the Phase 1, 2, and 3 investigations (i.e., qualifier "f" in the figure). Future construction activities at these locations will require notification to workers to ensure appropriate health and safety protocols are followed.

8.2.5 WATER SOLUBILITY

None of the Phase 3 groundwater samples exceeded the water solubility criteria (although the DNAPL sample from off-Site well MW-68D2 contains multiple constituents that would exceed the criteria). Figure 8.3 shows the exceedances of the water solubility criteria identified during the Phase 1 and 2 investigations. These exceedances will be considered in a Feasibility Study/Remedial Alternatives evaluation.

8.2.6 FLAMMABILITY AND EXPLOSIVITY SCREENING LEVELS

Flammability and Explosivity Screening Levels were exceeded at two Phase 3 monitoring well locations (MW-67D and MW-68D1). The benzene levels of 76 and 96 ppm, respectively, exceeded the criteria of 68 ppm. Figure 8.3 shows the exceedances of

the flammability and explosivity screening levels identified in the Phase 1, 2, and 3 investigations (i.e., qualifier "h" in the figure). According to Part 201 Criteria Application Guidesheet 8 for groundwater data, a toxicologist should be contacted for further evaluation for acute inhalation toxicity.

8.2.7 ACUTE INHALATION SCREENING LEVEL

Acute inhalation criteria was exceeded at two Phase 3 monitoring well locations (MW-67D and MW-68D1). The benzene levels of 76 and 96 ppm, respectively, exceeded the criteria of 67 ppm. Figure 8.3 shows the exceedances of the acute inhalation screening level identified in the Phase 1, 2, and 3 investigations (i.e., qualifier "i" in the figure). According to Part 201 Criteria Application Guidesheet 9 for groundwater data, a toxicologist should be contacted for further evaluation for acute inhalation toxicity.

8.2.8 FINAL ACUTE VALUE

With exception of several PRV samples on the east side of the river none of the Phase 3 groundwater samples exceeded final acute values. Figure 8.3 shows the exceedances of the final acute values identified on the Phase 1, 2 and 3 investigations. These exceedances will be considered in a Feasibility Study/Remedial Alternatives evaluation.

8.3 AIR

The Part 201 Criteria that were used to evaluate air sample results presented in the August 2005 RI report are currently under review by the MDEQ project toxicologist. Although the MDEQ has requested additional sampling be conducted, no additional air sampling has been or will be completed until additional discussions with MDEQ can establish appropriate criteria and/or protocols.

8.4 SURFACE WATER

Based on a review of the surface water sample analytical results collected as part of the IRA, it appears that the Unconfined and/or Semi-confined Zones on the Wayne County property may be discharging constituents to the Rouge River via the PRV subdrain system. The GSI and FAV exceedances associated with the discharge will be considered in a Feasibility Study/Remedial Alternatives evaluation.

9.0 PHASE 3 RI SUMMARY AND CONCLUSIONS

Between September 2006 and April 2007, a Phase 3 Remedial Investigation was completed at the Schaefer Road Area Site to assess the lateral and vertical extent of potential off-Site releases on the property. During the investigation:

- 30 soil borings were completed;
- 23 of the soil borings were completed as monitoring wells (5 locations were completed with 2 wells each, for a total of 28 monitoring wells);
- 34 soil samples were submitted for chemical analysis;
- 19 groundwater samples were submitted for chemical analyses;
- 7 groundwater samples were submitted from existing PRVs for chemical analysis; and
- 1 DNAPL sample was submitted for chemical analysis.

The soil, groundwater, DNAPL, and surface water samples were collected and analyzed to further define the hydrogeological conditions and distribution of chemical parameters identified in previous investigations. The Phase 3 results confirmed the presence of four geological units, that in descending order included: (1) a Fill Unit; (2) a Silty Sand Unit; (3) a Sand and Gravel Unit; and (4) a Silty Clay Unit. Laterally discontinuous saturated zones were confirmed in the Fill Unit and the Sand and Gravel unit. A figure showing the historic property use is presented in Figure 1.3. The soil boring and groundwater monitoring wells installed during the three RI phases is presented in Figures 2.1 and 2.2, respectively. Geologic cross-sections G-G' and H-H' (Figures 4.5 and 4.6) show the hydrogeological relationships at the Site.

Collectively, the data from the Phase 1, Phase 2, and Phase 3 Remedial Investigations in combination with results from previous investigations completed at or adjacent to the Site were used to assess the probable source, distribution, fate, transport, and potential exposure to VOCs, SVOCs, PCBs and metals detected at and/or adjacent to the Site. A technical analysis of the data is summarized below:

- During the Phase 1, 2 and 3 Remedial Investigations, 13 VOCs and 22 SVOCs were detected in soil and groundwater in concentrations above applicable generic MDEQ Part 201 industrial criteria. The highest concentrations of VOC and SVOC parameters occurred under the surface impoundment's that were part of the former manufactured gas plant operations south and west of the former Rouge River channel (Figure 1.2). The predominant source of the VOC and SVOC constituents

detected at the Site is concluded to be from releases associated with the surface impoundment's owned and operated by the former manufactured gas plant. A second source of the VOCs and SVOCs is an area within the former Melvindale Dump. Both of these sources were present on a 22-acre parcel that was acquired by Ford in 1968.

- During the Phase 1, 2, and 3 Remedial Investigations, PCBs were detected in only one groundwater sample at the Site. The PCB detected in the groundwater sample (Aroclor-1260) was in a concentration that exceeded generic MDEQ Part 201 industrial groundwater contact criteria). Detectable levels of PCBs were identified in less than 6 percent of the total samples collected (eight soil samples, one groundwater sample, and three DNAPL samples). The source of the PCBs detected at the Site is undetermined, but is likely related to former river sediment used as fill. The inconsistent distribution pattern of PCB detections indicates that the wastewater polishing lagoons are not a source of the measured PCBs. It should be noted that there was a former PCB-containing transformer at the Site near the clarifier office and a former PCB-containing transformer station on the adjacent manufactured gas distribution facility. However there is no known or documented PCB release from either Site.

- During the Phase 1, 2 and 3 Remedial Investigations, 19 different metals were detected in concentrations above applicable generic MDEQ Part 201 industrial criteria. The metals of most significance included available cyanide, mercury, lead, manganese, and chromium. The source of the available cyanide and mercury identified in soil and groundwater samples collected at and adjacent to the Site are suspected to be from former manufactured gas plant operations. The source of lead concentrations identified in fill materials deposited in the "Unused Area" is undetermined. The "Unused Area" is original Ford property but aerial photographs show fill material being introduced to the Site and grading operations being conducted on the former manufactured gas plant property, the former Ford property, and the property formerly occupied by the Rouge River. Additionally, the portion of the former manufactured gas plant property that was not acquired by Ford contained lead concentrations in soils at levels that are similar to the levels identified in the Unused Area. The sources of manganese or chromium identified at the Site are likely associated with the slag materials used to stabilize access roads around the Site.

The next three sections discuss the distribution and transport of DNAPL identified at and adjacent to the Site and its effect on soil, groundwater and surface water quality.

9.1 DNAPL SOURCE AND MIGRATION ASSESSMENT

Source and Characterization Assessment: During the Phase 1 and Phase 2 investigations, soil borings and monitoring wells completed in the west central portion of the Site identified free-phase, residual-phase, and dissolved phase hydrocarbon constituents in soil and groundwater that are similar to the constituents found in coal tar, a byproduct of the gas manufacturing process. This west central portion of the Site was an area formerly occupied by diked surface impoundments used to store coal tar and liquid wastes from former manufactured gas plant operations. The hydrocarbon constituents were predominantly identified in areas within and west of the former Rouge River between 5 and 40 feet below grade. Since these hydrocarbon residuals were identified up to and along the Site's western property boundary, the Phase 3 investigation focused on completing soil borings in off-Site areas directly west of the Site to define the lateral extent of the hydrocarbons. A portion of the off-Site area west of the Site was also occupied by the former gas plant impoundments and contained the same type of free-phase, residual phase and dissolved phase hydrocarbon constituents that were detected on-Site. During the Phase 1 and 2 investigations, free-phase DNAPL has been identified in six wells completed in the Sand and Gravel Unit (i.e., MW-04D, MW-04aD, MW-11D, MW-14D, MW-39D, and MW-49D). During the Phase 3 investigation, free-phase DNAPL was identified in one well completed in the Sand and Gravel Unit (i.e., MW-68D2). Each of the seven wells are located within or west of the former river channel (Figure 5.2).

The analytical data and distribution of the free-phase hydrocarbons indicate that the former manufactured gas plant impoundments are the most probable source of the DNAPL encountered at and adjacent to the Site. A potential second but much smaller source of DNAPL appears to be located within a former Army Corp fill area that is also located within the footprint of the former Melvindale Dump. The DNAPL has migrated downward through seepage and preferential pathways into the permeable Sand and Gravel Unit. After penetrating the Sand and Gravel Unit, the downward vertical migration of the DNAPL has been retarded by the low permeability surface of the 100-foot thick silty clay layer identified across the Site. The lateral movement of the DNAPL within the Sand and Gravel Unit has been dependent on the volume of DNAPL present at the location and the slope of the clay layer surface.

The surface of the clay layer under the former impoundment area slopes downward toward lower clay surface elevations to the south and east (Figure 5.2). This clay surface slope has allowed DNAPL to migrate laterally away from the impoundment area and converge toward and within the former river channel, where the lowest clay elevations at the Site were encountered. Upon reaching the former river channel, DNAPL movement would be reduced as the clay slope along the river bottom is more gradual than the clay slope perpendicular to the former river banks. Lateral DNAPL movement within the former river channel has also been retarded by and/or blocked by the steel sheet pile wall/level control weir that bisects the southern end of the Secondary Lagoon. This sheet pile wall was installed in 1973, after the Army Corps completed the Flood Control project and prior to Ford incorporating the Secondary Lagoon into the WWTP process. The top of the sheet pile wall across the former river channel acts as a level control weir for the surface water in the Secondary Lagoon (Figure 1.4).

It should be noted that the sheet pile weir does not effect the lateral migration of all the DNAPL detected at the Site. The sheet pile weir does not effect the lateral movement of DNAPL detected at off-Site monitoring well MW-68D2, which is located adjacent to the new Rouge River channel near pressure relief vent PRV-4E (Figure 5.2). The slope of the clay layer in this area is in a westerly direction towards the new river channel. As discussed in Section 4.1, the soil excavation activities for the new river channel directly west of MW-68D2 lowered the clay surface elevation to approximately 555 AMSL (Figure 4.4), creating a westerly slope in the clay surface in the immediate vicinity that did not previously exist. The sheet pile weir also does not effect the lateral movement of the DNAPL detected at on-Site monitoring well MW-39D in the former Melvindale Dump area, which appears to be a separate source area located hydraulically downgradient of the sheet pile weir. The lateral movement of DNAPL in these two areas is dependent on the slope of the clay layer in the immediate vicinity, therefore the likely migration pathway would be towards the new river channel. As shown in north-south geologic cross section H-H' (Figure 4.6), the bottom elevation of the sand and gravel unit in these two DNAPL areas is lower than the bottom elevation of the new Rouge River. Consequently, DNAPL at these locations may be able to migrate toward and possibly into the pea-gravel backfill associated with the former 30-inch dewatering line below the bottom of the new river channel.

The technical analysis and supporting technical data presented above indicates that the two apparent sources of DNAPL (i.e., the former gas plant surface impoundments and the Army Corp fill area within the Melvindale Dump) are on the 22-acre parcel that was

incorporated into the Site in 1968, which included a former manufactured gas plant impoundment/storage area and a municipal landfill site (i.e., a portion of the Melvindale Dump). The Phase 3 data indicates this on-Site DNAPL source area extends onto portions of the adjacent Wayne County property located directly west of the Site which is also former manufactured gas plant property. These DNAPL source area conclusions along with the vertical and horizontal migration scenarios are supported by the following data obtained during the remedial investigations:

(1) the presence of aboveground oil storage capacity up to 1 million gallons adjacent to the impoundments and unknown storage capacity within the 10-acre impoundment area on the former manufactured gas plant property (as identified in pre-1968 aerial photographs in Appendix D) indicate a hydrocarbon/DNAPL source was present on property for at least 20 of the 100 plus years of gas plant operations;

(2) the apparent backfilling of these former gas plant impoundment's between 1956 and 1969 without any documented remedial activities,

(3) the presence of "oily" soils and "tar" identified in soil borings completed on the former manufactured gas plant parcel in the 1967 and 1968 Army Corps investigations confirm that a DNAPL source was present within the 22-acre parcel prior to Ford's ownership;

(4) the results of the post-1968 investigations indicate the distribution of DNAPL at the Site is within or west of the former Rouge River channel and generally matches the location of the former impoundment areas shown in the aerial photographs. Additionally, the 1984 EDI investigation results on the west side of the new river channel near the former manufactured gas plant operations that were not part of the 22 acres acquired by Ford in 1953 identified hydrocarbon residuals or coal tar in soil borings completed on the current 30-acre gas distribution facility (EDI borings W-1, S-5, S-6, S-7, and S-9);

(5) the visual and physical characteristics of the DNAPL identified in on-Site and off-Site wells are consistent with those of coal tar (a brown/black color, a strong "moth-ball-like" odor, a specific gravity above 1.0, and a high viscosity);

(6) the chemical compositions between DNAPL samples appears similar from sample to sample with respect to the VOC and SVOC constituents identified by the laboratory, which indicates the samples are from a common source (Table 5.1, 5.2 and 5.3);

(7) The average clay elevation at locations where DNAPL was detected (see Table below) indicate that the DNAPL source was in the former impoundment area where the clay elevations were the highest (i.e., Clay elevations of 565.1 at MW-14D). DNAPL can migrate from the higher clay elevations at MW-14D to the lower clay elevations at MW-04aD, but cannot migrate from MW-04aD to MW-14D as DNAPL cannot migrate topographically upslope along the clay surface. A second DNAPL source could be located within an Army Corps fill area in a location once occupied by the former Melvindale Dump (i.e., at or near MW-39D);

Well Number	Clay Elevation
MW-14D	565.1
MW-39D	561.3
MW-49D	558.9
MW-68D2	558.0
MW-11D	557.1
MW-04D	555.2
MW-04aD	554.7

(8) the Sand and Gravel Unit in the western portion of the Site is laterally continuous and provides a migration pathway for lateral DNAPL movement (Figure 4.5);

(9) the absence of DNAPL identified in borings completed on the east side of the former Rouge River strongly suggests that the DNAPL was not generated from Ford/SNA's WWTP operations (i.e., as shown in Figures 5.1 and 5.2, no DNAPL or hydrocarbon residue was identified in CRA borings SB-8, SB-42, SB-43, SB-45 and Army Corps boring 13-67, all of which were located on the east side of the former river);

(10) the shape of the dissolved phase VOC and/or SVOC plumes in Site groundwater (Figures 9.3 and 9.4) strongly suggests that the source of these VOC and SVOC constituents originated on the former manufactured gas plant property as their shapes are similar to that expected before and after the Army Corps completed the Flood Control project (i.e., constituents migrating toward the former and new Rouge River channels).

(11) the general absence of dissolved phase VOCs and SVOCs on the east side of the original Rouge River supports that the source of these constituents originated on the west side of the original Rouge River (i.e., As shown in Figures 9.3 and 9.4, dissolved

phase benzene and naphthalene were not detected in semi-confined wells MW-20D, MW-21D, MW-25D, MW34D, and MW-51D).

DNAPL Exposure Pathway Assessment: The following exposure pathways associated with the DNAPL identified at the Site were assessed:

Drinking Water Criteria – No drinking water wells are allowed in Wayne County so the pathway is not applicable.

Groundwater Surface Water Interface Criteria – To CRA's knowledge, there is no continuous or periodic discharge of DNAPL into the new river channel from the SNA operations. However, there may be potential on the Wayne County property for DNAPL to migrate under the eastern portion of the Rouge River channel and into the trench associated with the 30-inch dewatering pipe.

Volatilization to Indoor Air Criteria - The Phase 2 Remedial Investigation report indicated analytical results from indoor air samples collected within the clarifier office at the Site show the DNAPL constituents do not result in indoor air exposure levels above applicable OSHA standards. However, additional volatilization to indoor air exposure pathway evaluations will be conducted with the assistance of the MDEQ Air Quality Division.

Direct Contact Criteria - exposure to DNAPL constituents is unlikely as it is encountered between 18 to 32 feet below grade on-Site and approximately 21 feet below grade off-Site at MW-68D2.

Flammability, Explosivity and Acute Inhalation Screening Levels – An ongoing manual DNAPL recovery program (bailing) is in place that utilizes the appropriate health and safety procedures. Results of removal efforts indicate that DNAPL recharge is very slow and does not warrant the installation of an automated recovery system. Other potential remedial alternatives will be evaluated during the Feasibility Study.

Final Acute Values – The presence of DNAPL has apparently contributed to dissolved phase VOC and SVOC concentrations on the Wayne County property that exceed FAV values that are protective of aquatic life and habitat (see the analytical results of PRV-3E and PRV-4E and Section 9.4 below). However, the application of FAV's to a river within a concrete channel (vs. a river with natural substrate) is being evaluated and will be further discussed in the Feasibility Study.

9.2 SOIL QUALITY SUMMARY AND CONCLUSIONS

Source and Characterization Assessment: The hydrocarbon product and DNAPL migration processes have left hydrocarbon residuals throughout the unsaturated geologic units above the clay layer (i.e., portions of the Fill Unit and Clayey Sand Unit). Based on the aerial photograph review, the source of these hydrocarbon residuals is related to the former manufactured gas plant surface impoundment's. These hydrocarbon residuals continue to act as sources that effect groundwater quality in the Unconfined and Semi-confined Zones. The Phase 1 and Phase 2 investigation results show that the lateral extent of the hydrocarbon residuals detected at the Site coincide with the 22-acre former manufactured gas plant property Ford acquired in 1968 and a portion of the former Rouge River (Figure 5.1). The Phase 3 investigation results identified that the lateral extent of these hydrocarbon residuals extend off-Site to the west, where their concentrations in native unsaturated soil are above applicable generic MDEQ Part 201 industrial criteria. These off-Site unsaturated soil impacts were detected between 2.5 and 5.0 feet below grade directly adjacent to the Rouge River (i.e., in soil borings SB-66, SB-67, SB-68, and SB-69). The investigation data support that the source of the hydrocarbon residuals is related to the former manufactured gas plant surface impoundment's; including:

(1) The chemical constituents detected in off-Site soils on Wayne County property are similar to hydrocarbon constituents identified in the DNAPL and the hydrocarbon constituents detected in on-Site soils:

(2) Approximately 98 percent of the total VOC and SVOC mass is located within or west of the former Rouge River channel. Based on soil sample analytical results from the remedial investigations (both on-Site and off-Site), approximately 88 percent of the hydrocarbon residuals are located on-Site within the 22 acres of the former manufactured gas plant property. An additional 5 percent of the mass in soils is located off-Site on the Wayne County property directly west of the Site (i.e., former manufactured gas plant property). An estimated 6 percent of the hydrocarbon mass in soils is located on-Site within the former Rouge River channel, and approximately 1 percent of the hydrocarbon mass is located on-Site within the original 13 acres Ford acquired prior to constructing their WWTP in 1953.

(3) The soils that exceed applicable generic MDEQ Part 201 industrial criteria identified on the adjacent 8-acre Wayne County property (former manufactured gas plant

property) appear to contain remnants of hydrocarbon residuals that were partially excavated by the Army Corps during the construction of the new channel. As identified in the Army Corps "as-built" plans for the river channel, soils excavated from the former manufactured gas plant property (currently owned by Wayne County) were deposited in the former river channel on the Site. Additional soils from the impoundment area were excavated to construct the Primary Lagoon and were re-distributed in the area currently occupied by the Diked Lagoon. The distribution of these hydrocarbon residuals was also effected by the Site grading activities as identified in aerial photographs between 1956 and 1969.

VOCs and SVOCs in Soil: The largest VOC and SVOC mass was detected in the Fill soils at the Site. This is concluded to be the result of hydrocarbons within the impoundments seeping into soils directly below them, some of which was then moved and re-deposited at the Site during post 1969 construction activities. The VOCs with the most locations exceeding MDEQ criteria include the following: 1,2,4-TMB, 1,3,5-TMB, benzene, toluene, ethylbenzene, and xylenes. The SVOCs with the largest number of MDEQ criteria exceedances include the following: 2-Methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo(a)pyrene, fluoranthene, fluorene, naphthalene, and phenanthrene.

PCBs in Soil: The maximum total PCB concentration detected in subsurface soils was 5.9 ppm (Aroclor 1260). This sample was collected during the Phase 2 investigation at SB-40 between 8 and 10 feet below grade. The data indicates these soils would be classified as non-TSCA material and are below the USEPA low occupancy direct contact criteria of 25 ppm. Furthermore, based on its depth, direct contact is not considered an applicable exposure pathway. The general absence of PCB detections are consistent with the absence of any known leaks or releases from a former PCB-containing transformer at the Site.

Metals in Soil: Concentrations of manganese and chromium in surface soil that exceed MDEQ particulate soil inhalation criteria (PSIC) cover approximately 75 percent of the Site (Figure 8.1). Based on the distribution of these constituents, it is expected that the majority of these exceedances are associated with the slag materials used to stabilize access roads around the WWTP. Concentrations of lead in surface soil that exceed MDEQ direct contact criteria cover approximately 150,000 square feet (or 3.5 acres) in the "Unused Area" of the Site.

Soil Exposure Pathway Assessment: The following exposure pathways associated with the impacted soils identified at the Site were assessed:

- Drinking Water Protection – Not applicable as residential, commercial, and industrial facilities are required to be connected to the municipal water supply.
- Groundwater Surface Water Interface Protection – The majority of VOC and SVOC GSIP criteria exceedances were in the fill material. The Feasibility Study will be evaluating potential remedial alternatives.
- Soil Volatilization to Indoor Air – As indicated in the Phase 2 RI report, analytical results from indoor air samples collected within the clarifier office at the Site show the hydrocarbon residuals in soil do not result in indoor air exposure levels above applicable OSHA standards.
- Particulate Soil Inhalation Criteria – The analytical results from ambient air samples collected at the Site during the Phase 2 RI show the manganese, chromium and lead levels do not result in exposure levels above applicable OSHA standards.
- Direct Contact Criteria – access is restricted to areas of the Site where lead levels exceed direct contact. Potential remedial alternatives will be evaluated in the Feasibility Study.
- Soil Saturation Screening Levels – No soil saturation screening levels have been exceeded in the two uppermost unsaturated geologic units identified at the Site (i.e., within the fill or silty sand unit).

9.3 GROUNDWATER QUALITY SUMMARY AND CONCLUSIONS

Source and Characterization Assessment: The vertical and lateral migration of DNAPL has created dissolved-phase hydrocarbon concentrations throughout the saturated zones above the clay layer (i.e., portions of the Unconfined Zone in the Fill Unit and the Semi-confined Zone in the Sand and Gravel Unit). This DNAPL, along with the hydrocarbon residuals in unsaturated soils, is a continuing source of the dissolved phase VOC, SVOC, and metal constituents identified in groundwater at and adjacent to the Site. These VOC and SVOC constituents have migrated in groundwater in directions hydraulically downgradient of the former impoundment area and/or in directions hydraulically downgradient of DNAPL that has migrated away from the former impoundment area. Prior to the Army Corps flood control project, the hydraulically downgradient groundwater flow direction would have been toward the former Rouge River channel. However, the 30-inch dewatering drain pipe constructed below the new river channel lowered water levels in off-Site areas and the construction sheet pile level control weir in the Secondary Lagoon created artificially high water levels on-Site. The result of these

two construction events reversed the natural hydraulic gradient and groundwater flow direction on the west side of the former Rouge River alignment. Prior to the completion date of the Secondary Lagoon (1973), the groundwater flow direction in the former impoundment area would have been toward the former river channel and after 1973, the hydraulic gradient and groundwater flow direction is toward the new river channel.

The post-1973 gradient toward the new channel is largely the result of hydraulic head created by the level control weir that elevated the surface waters of the Secondary Lagoon. These surface waters are hydraulically connected to the sand and gravel deposits on top of the clay. The high surface water levels force water through the sand and gravel deposits, which are sandwiched between two low permeability units. The weight and force of the surface water increases pore pressures within the sand and gravel zone and creates the semi-confined pressure conditions. This change in pressure has produced changes in the hydraulic gradient and changes in groundwater flow direction. The pre-1973 groundwater flow direction was toward the original Rouge River channel and the post-1973 groundwater flow direction is toward the new Rouge River channel. These changes in groundwater flow direction have changed the shape of the VOC and SVOC distribution migrating from the former manufactured gas plant impoundment area and/or the DNAPL areas. The distribution of VOCs, SVOCs and dissolved metals in groundwater identified at the Site follows the predominant groundwater flow paths, which are within the former river channel where the clay elevations are the deepest and where the sand and gravel zones are the thickest. The groundwater flow rates adjacent to the channel vary along the Sites western property boundary as the thickness and composition of the sand and gravel unit are not uniform (based on pumping tests completed in wells installed in the semi-confined zone during the Phase 3 investigation). As groundwater flows off-Site within the semi-confined sand and gravel zone, its direction is controlled by (1) the preferential pathway associated with the pea gravel backfill from the 30-inch dewatering pipe underneath the new channel; and (2) to a lesser extent, the 6-inch subdrain and PRV system located under the banks of the new channel. The current groundwater flow directions for the Site are presented in Figures 4.7 and 4.8.

VOCs and SVOCs in Semi-confined Groundwater: The dissolved phase VOC and SVOC constituents detected in groundwater in the semi-confined zone were similar to those detected in DNAPL. The similar constituents combined with the shape of the plumes that mirror the impoundment area indicate these VOCs and SVOCs are emanating from the sources identified on the former manufactured gas plant property.

Since benzene and naphthalene were the two of the most frequently detected VOC and SVOC constituents detected in groundwater, they were used as indicator parameters representative of other dissolved phase organic constituents. The concentrations of these two indicator parameters in the semi-confined zone are presented in Figures 9.1 and 9.2, and the concentrations detected in the Unconfined Zone are presented in Figures 9.3 and9.4. The concentrations of the two dissolved phase constituents are typically 1 to 4 orders of magnitude greater in the Semi-confined Zone than in the Unconfined Zone. Additionally, the saturated thickness of the Semi-confined Zone is 1.5 to 2 times as thick as the Unconfined Zone. The higher concentrations and greater saturated thickness indicates the majority of the contaminant mass is in the Semi-confined Zone.

Based on the westerly groundwater flow direction in the semi-confined zone, the dissolved phase VOC and SVOC constituents are migrating off-Site in concentrations that exceed applicable generic MDEQ Part 201 industrial criteria. These criteria exceedances are at locations that cover over 2,500 linear feet along the Sites western property boundary. As shown in north-south geologic cross section H-H' (Figure 4.6), the bottom elevation of the sand and gravel unit is lower than the bottom elevation of the new Rouge River channel at several locations, including: (1) areas where the former Rouge River channel bisects the new Rouge River channel; and (2) an area adjacent to monitoring well MW-68D2. Therefore, dissolved phase VOC and SVOC constituents at these locations may be able to migrate toward and possibly into the pea-gravel backfill associated with the former 30-inch dewatering line below the bottom of the new channel.

VOC and SVOCs in Unconfined Groundwater: Based on the groundwater flow direction in the Unconfined Zone, the dissolved phase VOC and SVOC constituents at the Site are migrating: (1) towards the Primary and/or Secondary Lagoon in the southern portion of the Site, or (2) towards the former river channel in the northern portion of the Site. The VOC and SVOC concentrations in the Unconfined Zone are generally 1 to 4 orders of magnitude less than the concentrations detected in the Semi-confined Zone but still exceed applicable MDEQ criteria. Based on a 6.5 foot difference in groundwater elevations identified in the unconfined shallow wells installed along the Sites western property boundary and the water levels observed in the off-Site PRVs located adjacent to the new river channel, the two Unconfined Saturated Zones do not appear hydraulically connected. Therefore, the VOCs and SVOCs detected in groundwater samples collected from the PRVs are likely related to groundwater that has seeped through the impacted soils identified on Wayne County property adjacent to the Rouge

River and potentially some impacted groundwater from the Semi-confined Zone that may be venting upwards within the permeable subgrade material below the concrete banks of the new Rouge River channel.

PCBs in Groundwater: PCB aroclor 1260 was detected in one groundwater sample collected from MW-14D at a concentration of 0.0079 ppm. This concentration is above the MDEQ generic Part 201 industrial groundwater contact criteria of 0.0033 ppm. This well also contains DNAPL that has a PCB aroclor 1260 concentration of 10 ppm. The absence of PCBs in all other groundwater analytical samples indicates PCBs in groundwater are not an issue.

Metals in Groundwater: Concentrations of 18 different metals detected in groundwater exceed one or more applicable MDEQ criteria. The groundwater surface water interface criteria is the most prevalent criteria exceeded and dissolved manganese is the most prevalent constituent that exceeds the criteria. A mixing zone calculation will likely be developed to replace the generic GSI criteria with Site-specific GSI criteria.

Groundwater Exposure Pathways: The following exposure pathways associated with the impacted groundwater identified at the Site were assessed:

- Drinking Water Criteria – No drinking water wells are allowed in Wayne County so the pathway is not applicable.
- Groundwater Surface Water Interface Criteria – This is the predominant MDEQ criteria exceedance by the VOCs, SVOCs, and metals identified at the Site. A Feasibility Study is currently being conducted to identify the most appropriate remedial alternative.
- Volatilization to Indoor Air Criteria - The Phase 2 RI report indicated analytical results from indoor air samples collected within the clarifier office at the Site show the dissolved phase groundwater constituents do not result in indoor air exposure levels above applicable OSHA standards. However, additional volatilization to indoor air exposure pathway evaluations will be conducted with the assistance of the MDEQ Air Quality Division.
- Groundwater Contact Criteria - exposure to VOC, SVOC or metals in groundwater in the Semi-confined Zone at the Site is unlikely as it is typically encountered between 15 to 22 feet below grade. Groundwater in the Unconfined Zone at the Site is typically encountered between 11 and 14 feet below grade, and does not contain any groundwater contact criteria exceedances. In off-Site areas the impacted groundwater in the Unconfined Zone does not exceed the groundwater contact

criteria, with exception of the groundwater collected from PRV-2E and PRV-4E. Potential remedial alternatives will be evaluated during the Feasibility Study.

- Flammability, Explosivity and Acute Inhalation Screening Levels – Monitoring wells where these exceedances were identified and have been equipped with appropriate labels to warn personnel of the hazards. Potential remedial alternatives will be evaluated during the Feasibility Study.
- Final Acute Values – Dissolved phase constituents in groundwater discharging from the PRVs exceed FAV values that are protective of aquatic life and habitat (see the analytical results of PRV-3E and PRV-4E and Section 11.4 below). However, as indicated above, these exceedances appear to be related to soil quality adjacent to the Rouge River and potentially impacted groundwater within the Semi-confined Zone that could be venting to the PRVs during periods of high pressure. The application of an FAV to a river within a concrete channel (vs. a river with natural substrate) is being evaluated and will be further discussed in the Feasibility Study.

9.4 SURFACE WATER QUALITY SUMMARY AND CONCLUSIONS

Source and Characterization Assessment: In November 2004 water samples were collected from each of the 5 PRVs located on the east side of the new Rouge River channel (i.e., PRV-1E through PRV-5E). The analytical results indicated GSI and FAV exceedances were present. In May 2005, the PRV's were re-sampled and the results confirmed at least one generic GSI criteria exceedance was detected at each PRV and FAV exceedances were present at PRV-3E and PRV-4E (Tables7.1 through7.4). The constituents detected were similar to those detected in soil, groundwater, and DNAPL in the area. However, since the PRV subdrain system does not conform with MDEQ-approved GSI monitoring point construction standards, the PRV analytical results were not considered representative. Therefore, 2-inch diameter monitoring wells were installed adjacent to the river and sampled during the Phase 3 Remedial Investigation.

GSI and FAV Compliance Assessment: The results of the Phase 3 sampling activities identified VOC, SVOC and FAV exceedances in groundwater sample analytical results from eight off-Site monitoring wells installed directly adjacent to the Rouge River channel (i.e., MW-60D, MW-66D, MW-67D, MW-68D1, MW-68D2, MW-69D, MW-70D, and MW-71D). These 2-inch diameter wells were installed in October 2006 and are located approximately 150 feet west of the SNA property boundary. An FAV exceedance notification letter consistent with the requirements of Rule 299.5716(14)(a) was issued to the MDEQ in December 2006 even though Ford and SNA do not own the

property where the FAV exceedances were observed, and are not believed to have responsibility for the observed chemical impacts. However, as discussed with MDEQ at a December 7, 2006 meeting, Ford and SNA submitted the written notification at the MDEQ's request and suggestion, in order to better advise MDEQ of the findings.

Subdrain Hydraulic Testing: In July and August 2006, as part of the IRA, hydraulic tests were completed at each of the five PRV cleanouts on the east side of the river to obtain a quantitative estimate of the groundwater capture and discharge volumes associated with the subdrain system. The readings obtained were from single monitoring events under normal flow conditions, and do not take into account potential lower flows during the late summer or a suspected spike in flows following precipitation events. The July 2006 results indicated that a total of 120 gallons per minute discharged to the river through the five PRVs located on the east side of the river (i.e., PRV-1E through PRV-5E). The August 2006 results indicated that a total of 67 gallons per minute discharged to the River through the PRVs. Using the average hydraulic conductivities obtained from the step tests conducted at MW-9D, MW-36D, and MW-38D (Table 4.1), these discharge values from the PRVs are approximately 40 to 70 percent of the conceptual groundwater flux that is migrating off the Site's western property boundary. Additional hydraulic testing may be conducted as part of the Feasibility Study to support these discharge estimates.

Surface Water Sampling: In May 2006, as part of the IRA Investigation, three surface water samples were collected from the Rouge River. These samples were labeled as SW-1, SW-2, and SW-3, and were collected at locations upgradient of PRV-1E, near PRV-3E and downgradient of PRV-5E. The analytical results indicate one VOC (benzene) was detected at SW-2 and SW-3 at concentrations above the laboratory reporting limit. The analytical results also indicate that hexavalent chromium was detected at SW-2 at a concentration above laboratory reporting limits. Estimated manganese concentrations were detected in all three surface water samples. Ammonia values were reported as non-detect but the reporting limit was above the Part 31, Rule 57 warm water Final Chronic Value of 0.053 due to method blank contamination. The surface water sample collected upgradient of the Site at the Rotunda station during the 1996 Rouge River study detected PCB concentrations above Part 31, Rule 57 water quality values (Table 7.7).

10.0 RECOMMENDATIONS

1. Additional investigation should be completed by other potentially responsible parties to assess the lateral migration of DNAPL and dissolved phase constituents in groundwater in areas underneath the Wayne County property and the current Rouge River channel.

2. Initiate a Feasibility Study/Remedial Alternative evaluation to develop, evaluate, and select appropriate response activities to control migration of impacted groundwater leaving the Site along the western property boundary (as part of continued efforts to address the MDEQ request for interim response activity);

3. Continue to implement a simple, product-only recovery system for the LNAPL and DNAPL identified at the Site and adjacent properties to comply with Part 201 free product recovery regulations outlined in Section 324.20114(1)(f) (as part of continued efforts to address the MDEQ request for interim response activity); and,

4. Develop a Site-specific Particulate Soil Inhalation Criteria (PSIC) for accurate comparison purposes based on the results of the RMC Site-specific PSIC calculation.

5. Develop and submit an indoor air quality monitoring program to the MDEQ Air Quality Divsion as requested by the agency to confirm the Phase 2 indoor air sampling results, which showed no potential exposures of concern.

11.0 REFERENCES

1. Aryan, S.G., Rathbun, J.E., and Mikesell, M.D. *Rouge River National Wet Weather Demonstration Project. Wayne County. Technical Memorandum, Assessment of Toxic Contaminants: 1996 Dry Weather Toxics Assessment Survey Results.* July 1998.
2. CRA 2006a. *Phase 3 Remedial Investigation Work Plan, Schaefer Road Area,* June 2006.
3. CRA 2006b. *Interim Response Activity Work Plan,* April 2006.
4. CRA 2006c. *Response to Comments, Phase 3 Remedial Investigation Work Plan – Schaefer Road Area,* March 2006.
5. CRA 2006d. *Response to Comments, Interim Response Activity Work Plan, Schaefer Road Area,* May 2006.
6. EDI. *Site Investigation. Former Coal Gas Manufacturing Plant, River Rouge, Melvindale, Michigan.* 1984.
7. MDEQ. Administrative Rules for Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act, 1994, Public Act 451, as amended. January 2006.
8. MDNR. Screening Site Inspection Report for Rouge River Fill Area, Melvindale, Michigan, U.S. EPA ID#MID985561944. September 1992.
9. United States Army Corp of Engineers, River Rouge, Michigan Flood Control Project Plans, 1969.
10. United States Army Corp of Engineers, River Rouge, Michigan Flood Control Project Plans – As Built, 1974.

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Christopher Black/R5/USEPA/US

05/22/2008 02:51 PM

To

Subject Shaefer Road Reports

Diane,

Attached is the 2007 Phase 3 Report on the Shaefer Road Area. The figures and tables are not included in the PDF, although results are summarized in smaller tables within the text. I do not have these figures or tables in hard copy. The 2005 Remedial Inv. Report on the Shaefer Road Area with figures and tables is on the window sill north of my cube. I also left the quarterly reports, sent from MDEQ, that show the progress from 2001 to the present on the window sill. Any other questions let me know.

Chris

Schaefer Rd Ph 3 RFI Rpt.pdf

REMEDIAL INVESTIGATION WORK PLAN

SCHAEFER ROAD AREA
DEARBORN, MICHIGAN

Prepared by:
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JANUARY 2001
REF. NO. 16636 (1)
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January 29, 2001

Reference No. 16636

Ms. Kimberly M. Tyson
Project Coordinator
Michigan Department of Environmental Quality
Waste Management Division
Hazardous Waste Program Section
P.O. Box 30241
Lansing, Michigan 48909

Dear Ms. Tyson:

Re: Remedial Investigation Work Plan
Schaefer Road Area
Dearborn, MI

On behalf of Rouge Steel Company and Ford Motor Company, we have enclosed three (3) copies of the Remedial Investigation Work Plan submitted for MDEQ review and approval in accordance with Section 8.7.2 of the Corrective Action Consent Order (WMD Order No. 111-04-00).

If you have any questions, please do not hesitate to contact our office.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

Jerry Biersteker

for Alan W. Van Norman, P.Eng.

JB/pw/1
Encl.
c.c.: Don Windeler, RSC
Jerry Amber, Ford
Dave Miller, Ford
Kathy Hofer, Ford
Meg Garakani, MichCon (2 copies)
Scott Dismukes, Doepken, Keevican & Weiss
Jerry Biersteker, CRA
Gordon Hotchkiss, CRA

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES
(Following Text)

LIST OF TABLES
(Following Text)

LIST OF APPENDICES

LIST OF ACRONYMS

AST	Aboveground Storage Tank
bgs	Below Ground Surface
CCR	Current Conditions Report
CRA	Conestoga-Rovers & Associates
Ford	Ford Motor Company
GIHBDW	Generic Industrial Health Based Drinking Water Values
ID	Identification
IDC	Michigan Generic Industrial Direct Contact Standards
IDWP	Michigan Generic Industrial Drinking Water Protection Criteria
GCC	Michigan Generic Groundwater Contract Criteria
IDWC	Michigan Generic Industrial Drinking Water Criteria
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MichCon	Michigan Consolidated Gas Company
NPDES	National Pollutant Discharge Elimination System
PA	Preliminary Assessment
PA/VSI	Preliminary Assessment/Visual Site Inspection
PCB	Polychlorinated Biphenyls
RSC	Rouge Steel Company
SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
VSI	Visual Site Inspection

1.0 INTRODUCTION

This document presents a work plan for the Remedial Investigation at the Schaefer Road Area (Site) in Dearborn, Michigan. This Remedial Investigation Work Plan (Work Plan) was prepared by Conestoga-Rovers & Associates (CRA) on behalf of the Ford Motor Company (Ford) and Rouge Steel Company (RSC).

1.1 GENERAL

The Site is located in the County of Wayne, State of Michigan, at 42° 17' 41" north latitude and 83° 10' 21" west longitude. The Site is located on approximately 45 acres of land at the southwest corner of the intersection of Schaefer Road and Butler Road. The general geographic location of the Site is presented on Figure 1.1. The city limits as presented on Figure 1.1 appear to follow an old alignment of the Rouge River placing the Site in both the City of Dearborn and Melvindale.

Prior to Ford's purchase of the property the only known land use was farming. Since the Ford purchase, the property has been used for wastewater treatment.

In 1968, Ford acquired a portion of the property comprising the Site from the Michigan Consolidated Gas Company (MichCon), which owned and operated a former manufactured gas plant across the river from the Site. In 1969, the United States Army Corps of Engineers (USACE) channelized and straightened the Rouge River through the Site. The realignment resulted in Ford and MichCon owning all lands on their respective sides of the Rouge River, up to the banks of the newly channelized river. In 1989, the Site was sold to RSC but the land use did not change.

Part of the former Rouge River bed was filled with by-product materials from the Rouge Manufacturing Complex. The former Melvindale Dump was located adjacent to the former alignment of the river near the Site and may have overlapped the Site. Melvindale Dump materials may also have been placed on the Site during the Rouge River realignment.

The Schaefer Road Wastewater Treatment Plant is currently operating at the Site and treats steel manufacturing process wastewater and stormwater runoff. The Site features include two grit chambers, a pump station, two oil skimmers, an oil house, three sludge ponds, and Primary and Secondary Oil Polishing Lagoons. A Site plan is presented on Figure 1.2.

1.2 REMEDIAL INVESTIGATION WORK PLAN OBJECTIVES

The objectives of the Remedial Investigation Work Plan are to:

- characterize the nature and extent of any potential releases of hazardous substances;
- assess potential risk to public health, safety, or welfare, or to the environment associated with any potential releases of hazardous substances;
- determine whether interim response activities are necessary to remove liquid phase hazardous substances and/or prevent fire or explosion, direct contact hazard, and/or groundwater contamination; and
- determine whether a response activity evaluation based on the current industrial land use being continued into the future is necessary to achieve the cleanup criteria specified in Part 201 of Public Act 451.

1.3 WORK PLAN ORGANIZATION

The Remedial Investigation Work Plan is consistent with USEPA and MDEQ-WMD guidance. The Remedial Investigation Work Plan is organized as follows:

- Section 1.0 - Introduction: This presents an introduction to, and organization of, the Remedial Investigation Work Plan.
- Section 2.0 - Description of Site: This section summarizes general conditions at the Site, including the Site location, historical property ownership, current and historical operations at the Site, and current and historical waste management practices at the Site.
- Section 3.0 - Regional Setting: This section summarizes local land use, demographics, climate, regional geology, regional hydrogeology, and regional hydrology.
- Section 4.0 - Site Setting: This section summarizes the geology, hydrogeology, and hydrology at the Site. In addition, this section presents the local topography of the Site.
- Section 5.0 - Remedial Investigation Scope of Work: This section presents the current status of the Site, and describes the proposed investigation.

- Section 6.0 - Data Evaluation: This section describes the proposed method for evaluating the Remedial Investigation data. This will consist of data analysis, review of exposure information, and post-investigation evaluations.
- Section 7.0 - Reporting: This section outlines the reporting requirements associated with the Remedial Investigation, including the Remedial Investigation Report.
- Section 8.0 - Remedial Investigation Schedule: This section presents the Remedial Investigation schedule.
- Section 9.0 - References: This section provides references for the documents cited in this Remedial Investigation Work Plan.

This document also includes the following appendices:

- Appendix A - Historical Borehole and Test Pit Logs: Appendix A presents borehole and test pit logs from previous investigations.
- Appendix B - Project Management Plan (PMP): The PMP presents a discussion of the project team organization and the responsibilities of the project team members. The qualifications of personnel performing or directing the Remedial Investigation are also included.
- Appendix C - Quality Assurance Project Plan (QAPP): The QAPP presents organization, objectives, planned activities and specific quality assurance/quality control (QA/QC) procedures which will be utilized during implementation of the Remedial Investigation Work Plan.
- Appendix D - Data Management Plan (DMP): The DMP presents procedures to be employed for managing information, reports, and correspondence associated with the implementation of the Remedial Investigation Work Plan.
- Appendix E - Site Health and Safety Plan (HASP): The HASP presents the minimum health and safety standards to be met by all personnel during implementation of the Remedial Investigation Work Plan.
- Appendix F - Field Sampling Plan (FSP): The FSP presents procedures for the collection of surface soil, subsurface soil, and groundwater samples (if required).

2.0 DESCRIPTION OF SITE

2.1 SITE LOCATION

The Site is located in the County of Wayne, Cities of Dearborn and Melvindale, State of Michigan, at 42° 17' 41" north latitude and 83° 10' 21" west longitude. The Site is located on approximately 45 acres of land at the southwest corner of Schaefer Road and Butler Road. The general geographic location of the Site is presented on Figure 1.1. The Site is bordered to the north by Butler Road; to the east by Schaefer Road; and to the south and west by the Rouge River. The Site boundaries, features, and support facilities are presented on Figure 1.2. The substation is located on property owned by RSC.

2.2 PROPERTY OWNERSHIP HISTORY

Ford acquired the property on which the Schaefer Road Area is located in 1938. The wastewater treatment plant was built in 1953.

In 1968, Ford acquired a portion of the property comprising the Site from the Michigan Consolidated Gas Company (MichCon), which owned and operated a former manufactured gas plant across the river from the Site. In 1969, the United States Army Corps of Engineers (USACE) channelized and straightened the Rouge River through the Site. The realignment resulted in Ford and MichCon owning all lands on their respective sides of the Rouge River, up to the banks of the newly channelized river.

The portion of the Site that was owned by MichCon prior to 1968 was associated with a former manufactured gas plant that was built in 1925 and demolished in phases throughout the 1950s and early 1960s.

2.3 CURRENT AND HISTORICAL OPERATIONS

2.3.1 CURRENT OPERATIONS

The Schaefer Road Area is comprised of a wastewater treatment plant along Schaefer Road and an area of currently unused property along Butler Road.

The wastewater flow path through the Site is described below and presented on Figures 2.1 and 2.2.

Wastewater from the adjacent Rouge Manufacturing Complex is received at two grit separation chambers with screens to remove large debris located at the northeast corner of the Site along Schaefer Road. From the grit chambers the wastewater is pumped through a 66-inch reinforced concrete pipe forcemain to two oil skimming clarifiers located at the southeast corner of the Site. The clarifiers separate oil and solids from the wastewater stream. Skimmed oil is pumped to a tank located in the oil house, prior to removal from the Site for recycling. The solids are removed and placed in one of two sludge ponds located southwest of the clarifiers. After further separation of liquids in the sludge ponds the partially dewatered sludge is solidified with lime, and removed to an off-Site landfill.

The wastewater from the clarifiers is piped underground through a 12-inch reinforced concrete pipe to the south end of the Primary Oil Polishing Lagoon at the west side of the Site. The wastewater flows northward in the lagoon past an oil mop skimmer, two oil booms, and an underflow weir to exit the lagoon at the northeast corner. An 84-inch pipe transfers wastewater from the Primary Oil Polishing Lagoon to the Secondary Oil Polishing Lagoon to the east. The secondary lagoon includes another oil skimmer and several oil booms to handle any residual oil as the liquid flows south and exits the lagoon through a 103-inch reinforced concrete pipe that discharges the treated water to the center of the Rouge River (Outfall 001).

Vacant land not currently developed or in use is present to the north and west of the Diked Lagoon and south of Butler Road as shown on Figure 1.2.

2.3.2 HISTORICAL OPERATIONS

Non farming land uses began in 1953 when the Schaefer Road Wastewater Treatment Plant was constructed. The Wastewater Treatment Plant was upgraded in 1973. Historic wastewater treatment operations were, in general, similar to the current processes described in Section 2.3.1.

A portion of the property is associated with a former manufactured gas plant. The gas plant's production operations were not located on the lands included in the Schaefer Road Area. However, one aboveground oil storage tank, a portion of the gas plant's tar storage area, and dikes surrounding each were located on what is now the southwest edge of the Schaefer Road Area.

In addition, beginning in approximately 1958, the City of Melvindale operated a landfill on a part of this area. This operation was known as the Melvindale Dump and was located on property owned by the Michigan Consolidated Gas Company. Part of the Melvindale Dump was excavated to construct the Rouge River Channel. The remainder of the Melvindale Dump was located on land sold to the Ford Motor Company and is located south of the Primary Oil Polishing Lagoon.

Figure 2.3 presents the current Schaefer Road Site superimposed on the original Rouge River alignment and portions of the former manufactured gas plant related to the Site along with the Melvindale Dump.

The former Rouge River channel was reportedly filled with by-product materials after the new Rouge River channel construction was complete. Materials that may have been used as fill are reported in a May 30, 1989 letter from Ford to the USEPA. The locations, dates and quantities of each material disposed of are unknown but may include:

- prior to 1985 liquid waste loads containing water and tramp oils up to 50 percent by volume;
- fly ash and bottom ash material from the Rouge Complex Power House;
- refractory linings from the Blast Furnace Facility and Coke Oven Facility;
- foundry sands and baghouse dust from the Dearborn Specialty Foundry and the Dearborn Iron Foundry;
- glass polishing rouge and glass cullett from the Dearborn Glass Plant;
- sand cores from the Dearborn Iron Foundry and Dearborn Specialty Foundry;
- coking tar wastes, scrap coke and coke oven breeze from the Rouge Coke Oven Facility;
- filter cake from the Blast Furnace Wastewater Recycle Facility;
- flue dust from the Blast Furnace Facility;
- lubricating and cutting oils from various manufacturing operations in the Rouge Complex;
- lubricating oil filtration solids, machining residue, and powdered magnesium from the Dearborn Engine Plant;
- tires and batteries from various vehicle maintenance operations in the Rouge Complex;
- propane tanks used on various material handling vehicles in the Rouge Complex;

- construction demolition debris, excavated soils, creosoted wood block flooring, railroad ties, and railroad bed slag ballast from the Rouge Complex; and
- empty 55-gallon steel drums.

2.3.3 CHRONOLOGY OF DEVELOPMENT

The Schaefer Road Wastewater Treatment Plant was constructed in 1953 and consisted of the two grit chambers, the two clarifiers, and the East and West Sludge Ponds. In 1969, a Supplemental Oil Polishing Lagoon, now known as the Primary Oil Polishing Lagoon was constructed.

During the late 1960s and early 1970s a concrete channel was constructed for the Rouge River as part of a United States Army Corps of Engineers flood control project. The new channel was generally constructed on a different alignment than the original, natural channel. Construction of the new alignment required excavation of former coal tar lagoons south west of the present day Primary Oil Polishing Pond and excavation of the City of Melvindale Dump south of the present day East and West Sludge Ponds. Both of the excavated units, the coal tar lagoons and the dump were on the other side of the original, natural Rouge River on property not owned or controlled by Ford or RSC. The disposition of the excavated materials is not precisely known.

In 1973, after the Rouge River Channelization was completed, the Secondary Oil Polishing Lagoon was constructed within the former original Rouge River Channel. Sometime after 1973, the Diked Lagoon was constructed at the location presented on Figure 1.2. This location overlaps the former, original Rouge River Channel.

In 1990, an interim measure was completed in the realigned Rouge River channel adjacent to the Site. The interim measure involved the containment and prevention of human exposure to a tar-like residue that appeared at several locations along the river channel.

Sorbent booms and oil skimmers have been periodically added and upgraded since the construction of the oil polishing ponds.

2.4 CURRENT AND HISTORICAL WASTE MANAGEMENT PRACTICES AND REGULATORY HISTORY

Wastes have been generated at the Schaefer Road Wastewater Treatment Plant since the start of operations in 1953. These wastes were primarily generated in removal of waste oils and solids from the wastewater stream treated at the Site. The waste management activities associated with operation of the Site are summarized in this section, including the Site's waste generation, treatment, storage, and disposal practices.

2.4.1 REGULATORY

The known regulatory history of the Site, including a description of relevant permits, is presented in this section.

The Site currently has an active National Pollutant Discharge Elimination System (NPDES) Permit No. MI0043524 for discharge of treated process water, contact cooling water, non-contact cooling water, boiler blowdown, and storm water runoff from Outfall 001 to the Rouge River.

On May 4, 1990, U.S. EPA issued an Unilateral Administrative Order to the Ford Motor Company requiring Ford to construct an engineered cover over several discrete areas along the Rouge River. The work requested in the Order was completed by Ford and Michcon by June 8, 1990 and is documented in the Report of Field Activities for the Rouge River Fill Area dated June 27, 1990.

2.4.2 CURRENT WASTE GENERATION AT TREATMENT PLANT

The non-hazardous wastes generated at the Wastewater Treatment Plant (to the extent that information about them is available) are summarized in this section. No hazardous wastes are generated at the Site.

The non-hazardous wastes generated at the Site include:

1. waste oil removed from the wastewater stream at the oil skimming clarifiers and the oil polishing ponds; and
2. sludge/solids removed from the wastewater stream at the grit chambers and oil skimming clarifiers.

2.4.3 HISTORICAL WASTE GENERATION

Historical waste generation from the Schaefer Road Wastewater Treatment plant was essentially the same as the current waste generation described in Section 2.4.2. The Wastewater Treatment Plant is the only Schaefer Road Area operation that generated waste.

2.4.4 CURRENT WASTE STORAGE

Waste storage practices are summarized in this section for each of the non-hazardous waste streams identified in Section 2.4.2:

- waste oil is collected from the skimmers and stored in an above ground storage tank located in the oil house;
- sludge/solids from the oil skimming clarifiers and grit chambers is dewatered in the East and West Sludge Ponds prior to removal for disposal;
- waste oil from the Primary and Secondary Oil Polishing Lagoons is stored in aboveground tanks located between the Primary and Secondary Oil Polishing Lagoons; and
- sludge/solids from dredging the Primary and Secondary Oil Polishing Lagoons is transferred to the large sludge ponds at the north end of the treatment plant area for subsequent dewatering and disposal.

2.4.5 HISTORICAL WASTE STORAGE

Prior to the relocation of the Rouge River, waste oil from the Wastewater Treatment Plant was collected and stored in an aboveground storage tank located in the control house currently called the oil house. Sludge solids from the oil skimming clarifiers and grit chambers was dewatered in the East and West Sludge Ponds prior to removal and disposal off Site. The Primary and Secondary Oil Polishing Lagoons and the Diked Lagoon did not exist prior to the Rouge River relocation.

2.4.6 – CURRENT WASTE DISPOSAL

The following is a summary of waste disposal practices for each non-hazardous waste stream identified in Section 2.4.1:

- recovered waste oil is removed by a licensed contractor for off-Site recycling; and
- sludge from the large sludge pond at the north end of the Site is mixed with lime adjacent to or in the sludge pond to solidify the waste and then removed to a licensed landfill for disposal.

2.4.7 HISTORIC WASTE DISPOSAL

Historic waste disposal from the wastewater treatment operation was essentially the same as current practice:

- recovered waste oil was removed off Site for disposal; and
- sludge was solidified and disposed off Site.

Part of the Site was used for waste disposal by the City of Melvindale. The approximate location of this disposal is presented on Figure 2.3.

The former Rouge River Channel was reportedly filled with a variety of materials that may include nonhazardous waste materials. The locations, dates and quantities of fill materials are unknown.

2.4.8 HISTORIC WASTE SPILLS

There are no known historic waste spills.

3.0 REGIONAL SETTING

3.1 REGIONAL LAND USE

The Site is located in both the Cities of Dearborn and Melvindale, is west of the City of Detroit and east of the City of Allen Park as shown on Figure 3.1. The Site boundaries extend to Butler Road to the north, Schaefer Road to the east, the Rouge River to the south, and the Rouge River and City of Dearborn property to the west. Figure 3.1 also shows that the Site is entirely surrounded by industrial properties and does not share a common property line with any non-industrial land use.

The industrial property bordering the north, east and west portions of the Site are located within the City of Dearborn. These City of Dearborn industrial properties are zoned for light, medium, and/or intensive industrial use (City of Dearborn designations IA, IB, and IC). A mixture of commercial and residential properties border the fringe of industrial properties that surround the Site.

The industrial properties bordering the south side of the Site (south of the Rouge River) are located within the City of Melvindale. The Melvindale industrial properties are zoned for light and general industrial use (City of Melvindale designations M-1 and M-2).

3.2 REGIONAL WATER SUPPLY

Potable water for the cities of Dearborn, Melvindale, and Detroit is treated surface water from the Detroit River, which is located approximately 2.5 miles east of the Site. Personnel at the Detroit Water and Sewer Department, Systems Control Division (Urbas, August 31, 2000) report that potable water for the area surrounding the Site is supplied from the Belle Isle intake in the Detroit River. Water from the intake is treated at the Springwells Treatment Plant in Dearborn.

According to personnel at the City of Dearborn Water Department (Cantor, September 20, 2000), the treatment process for the Detroit River water involves use of chlorine to eliminate bacteria, carbon to eliminate odors, alum (flocculent) to eliminate turbidity, and sand media as a final filter. After treatment, the water is distributed to approximately 32,600 dwellings throughout the City. Of these 32,600 accounts, approximately 3,200 are industrial/commercial and the balance is residential. Ford

Motor Company, the largest employer in the City of Dearborn, uses approximately 40 percent of the water treated at and distributed from the Springwells facility.

According to personnel at the Dearborn Environmental Health Department (Jackson, September 19, 2000) and the Wayne County Health Department, Community and Industrial Hygiene Division (Max, September 20, 2000), there are no known potable water wells in the City of Dearborn or Detroit. Additionally, Detroit adopted the Building Officials Council of America (BOCA) National Plumbing Code (1993) which requires all dwellings to connect to the municipal water supply if it is within 200 feet of a sewer. According to Health Department personnel, the City water and sewer system is available within 200 feet of every building throughout the entire City.

3.3 REGIONAL DEMOGRAPHICS

As indicated in Section 3.1, the Site is situated in the Cities of Dearborn and Melvindale. The Site is located in the southeast corner of the City of Dearborn, Township 10 and 11 East, Range 2 South, Wayne County, Michigan. The City of Dearborn is approximately 24.5 square miles, has a population of approximately 90,000, and a median age of 36 years (Dearborn Community Profile, 1999). Its largest employers are related to the automotive industry and include Ford Motor Company, Visteon Corporation, Lear Corporation, and AAA Michigan. The City of Melvindale is approximately 2.7 square miles, has a population of approximately 11,000, and a median age of 34.4 years (The News Herald Newspaper, 2000).

3.4 CLIMATE

National Climatic Data Center meteorological data from Station 202015 in Dearborn, Michigan were reviewed for the years 1961 through 1990. Average annual temperatures, precipitation records, and wind speeds over this 29-year timeframe are presented below. Monthly averages for January and July are also presented. Additionally, the record high and low temperatures are 104°F and minus 20°F, respectively. The record daily precipitation is 3.98 inches (September 7, 1990). The prevailing wind direction is from the northwest to southeast.

Climatological Data 1961 through 1990	*January (Monthly Avg.)*	*July (Monthly Avg.)*	*Annual (Average)*
Mean Temperature (°F)	22.9	72.9	48.9
Maximum Temperature(°F)	30.3	83.8	58.4
Minimum Temperature (°F)	15.5	61.9	39.5
Mean Precipitation (Inches)	1.63	3.19	32.71
Maximum Precipitation (Inches)	4.30	7.78	45.79
Minimum Precipitation (Inches)	0.23	0.49	19.44
Average Wind Speed (MPH)	11.9	8.6	10.3
Maximum 5-sec Wind Speed (MPH)	53	67	53.5

3.5 REGIONAL GEOLOGY

3.5.1 OVERBURDEN

The surficial geology of the region is dominated by unconsolidated glacial sediments deposited approximately 14,500 years ago (Farrand, 1988) during the Wisconsin stage glaciation (the last of four major glacial advances across Michigan). As the Pleistocene-age glaciers retreated, various depositional and/or erosional environments formed the basic landscape observed today. The most prominent features in the region (Wayne County) consist of a series of moraines, lakes, and rivers. Additional information on these regional geomorphic features and depositional environments are described below.

The glacial moraine deposits are located in and limited to the northwest corner of Wayne County (Figure 3.2). The moraine deposits generally consist of interbedded sands, gravels, silts, and clays that accumulated at the edge of the ice sheets during the glacial retreat. The glacial deposit is characterized as brown to gray poorly sorted mixtures of sand, gravel, silt, and clay. The moraine deposits form elevation highs for the area (950 feet AMSL) and are generally approximately 150 feet thick. The glacial moraine deposits taper into glacial and glacial-lacustrine deposits of sand, sandy clay, and silty clay. As shown on Figure 3.2, the glacial lacustrine (lake bed) deposits occupy the majority of the county.

As shown on Figure 3.2, the former lake bed areas are relatively flat with a gentle slope to the southeast toward the Detroit River. The lake bed deposits generally consist of silts and clays that accumulated in the flat or low-lying areas formerly inundated by the Glacial Great Lakes. The lacustrine silt and clay unit is characterized as bluish to light olive-gray, mottled, with trace amounts of well-rounded pebbles. The surficial geology clay may contain vertical hairline fractures from wetting/drying or freezing/thawing cycles that decrease with depth. These lacustrine deposits appear to thicken in an easterly direction toward the Detroit River. The elevation of the clay unit surface generally ranges from 620 to 580 feet.

The glacial and glacial-lacustrine deposits have been eroded and reworked in areas along the Rouge River. Many of the reworked sediments have been redeposited along the riverbanks. Urbanization has also influenced the surficial geology through physical removal, redistribution (grading), and/or the covering of sediments.

Based on information contained in the "Soil Survey of Wayne County, Michigan," the surficial geology soil horizons in the vicinity of the Site consist of urban land and soils from the Hoytville-Nappanee association (United States Department of Agriculture and the Soil Conservation Service, 1976). In general, these soils are characterized by a surficial geology 7- to 9-inch horizon of gray clay loam and silty loam that formed in level to gently sloping areas (i.e., former lake-plains). The soils are very poorly drained and somewhat poorly drained, respectively, and have a fine textured silt and clay subsoil. USCS classifications are "CL" and "ML" for the upper 7 to 9 inches and "CH" from 9 to 60 inches. USCS characteristics for this soil horizon indicate the permeability is slow (typically between 0.6 and <0.06 inches per hour for "CH" subsoils). The Hoytville-Nappanee soils are suited to crops commonly grown in the area (corn, oats, wheat, and soybeans) and woodlands (dogwood and various ornamental varieties).

Figure 3.2 presents information on the Regional Surficial Geology, the Regional Glacial Drift Thickness, and the General Soil Associations for the Wayne County area.

3.5.2 BEDROCK

Below the unconsolidated glacial drift, several bedrock formations of the Michigan Basin are encountered (the Michigan Basin is an accumulation of concentric bowl-shaped deposits of sedimentary rock that gently dip toward the center of the basin – which is located near the center of Michigan's lower peninsula). The southeastern edge of this basin in the Wayne County area consists of a Devonian-aged carbonate-evaporite

sequence. It is composed of shales, limestones, dolomites, gypsums, anhydrites, and halites.

The specific bedrock formations found in the region from youngest to oldest include the Antrim Shale, Traverse Group, the Dundee Formation, and the Detroit River Group. These bedrock units and others in the Michigan Basin thin in an outward direction and range from 3,000 to 6,000 feet in thickness in the Wayne County area. The dip in the formations is generally towards the northwest. However, the bedrock surface in the area slopes gently downward in an easterly to southeasterly direction toward the Detroit River. The bedrock surface elevation in the vicinity of the Site is expected to be between 450 and 500 feet AMSL.

Figure 3.3 presents the Bedrock Geology, and Bedrock Surface elevations for the Wayne County area.

3.6 REGIONAL HYDROGEOLOGY

Both the glacial overburden and the bedrock in Wayne County have water bearing geologic units. The glacial overburden in the area consists mainly of low permeability moraine and lake bed deposits that are poor sources of groundwater. As described below, the bedrock formations are considered a more reliable source of groundwater.

The moraines in the northwestern portion of Wayne County are made up of poorly stratified and poorly sorted sand, gravel, silt, and clay material. The heterogeneous mixture limits the space available for groundwater storage and therefore these types of deposits do not yield or transmit large quantities of water. As a result, groundwater typically encountered in glacial overburden in this area is generally of limited extent and usability. In many locations, groundwater may be considered to be present as "groundwater not in an aquifer".

The former lake bed deposits are predominately silt and clay material which exhibit very slow percolation rates and very low recharge rates. As a result, these clay-rich deposits typically produce little or no water and can not produce a sustainable yield. However, as shown on Figure 3.2, the surficial geology map shows some sand deposits in the former lake bed areas. These deposits are generally thin, laterally discontinuous deposits that are underlain by low permeability clay deposits. These isolated sand deposits do not produce significant amounts of water and typically yield less than 10 gallons per minute (Twenter, 1975). When groundwater is encountered within the

unconsolidated deposits, the water table is typically very high due to the shallow depth in which clay deposits are encountered. These scenarios generally result in perched water conditions that vary based on seasonal precipitation. Groundwater recharge and movement in these areas are often controlled by surface water runoff and permeable backfill material within utility corridors.

The Devonian-age limestone and dolomite in the Traverse Group, Dundee Formation and Detroit River Group yield water to wells in their subcrop areas. Most wells are intended for domestic supply, but some are used by small municipalities and industries (Twenter, 1975). Yield is generally less than 100 gallons per minute but may be larger, depending on the size, number, and relationship of joints, fractures, and solution cavities. The quality of water from these rocks ranges from potable to highly mineralized. Typically, deeper water sources have a greater degree of mineralization. In areas where significant clay deposits overly the bedrock units, groundwater encountered in the Devonian formations is likely encountered under confined conditions (i.e., pressurized conditions that cause the potentiometric surface of the bedrock groundwater to rise above the top of bedrock and into the overlying clay). In some areas of southern Wayne County, groundwater in bedrock formations is encountered in artesian conditions. In these flowing bedrock wells, depth to water (from ground surface) in the Devonian formation is equal to or less than zero. Public sources of information on the groundwater flow direction in the bedrock were not available but it likely conforms to an easterly regional flow pattern.

3.7 REGIONAL HYDROLOGY

The Rouge River drainage basin encompasses approximately 467 square miles within Oakland, Washtenaw, and Wayne Counties. The majority of the basin is drained by the three main tributaries of the Rouge River: the Upper Rouge River, the Middle Rouge River, and the Lower Rouge River. After their confluence near the city of Dearborn, the Rouge River flows in an easterly to southeasterly direction until it discharges into the Detroit River, which is located approximately 2.5 miles east of the Site. The Detroit River flows in a southerly direction and discharges into Lake Erie, which is located approximately 14 miles south of the study area. The Rouge River and its Tributaries are used for commerce and recreational purposes. Due to the highly variable flows and the relatively low permeability of the surrounding clay-rich lake bed deposits, the Rouge River is more likely to flood (as compared to streams underlain by permeable materials in areas of relatively uniform discharges). As a result of these conditions, the Army Corps of Engineers initiated a flood control program in 1969 wherein a portion of the

River was channelized for flood control. Although no gauging station currently monitors the Rouge River near the Site, the estimated historic daily mean discharge rate would be approximately 356 cubic feet per second. This estimate is based on combined daily discharge rates recorded from stations on the Upper, Middle, and Lower Rouge Rivers and does not account for permitted discharges to the river that occur downgradient of those stations (Station #04166500, #04167000, and #04168000).

3.8 REGIONAL SUMMARY

The Site is located in an intensely developed, heavily industrialized portion of the City of Dearborn, a suburb of Detroit. The full range of municipal services is available to the Site and surrounding neighborhoods. Of particular significance is the availability of municipal water and sewer services.

The regional climate generates a surplus of moisture during most of the annual cycle of seasons. The intense development (roofs and pavement) and the natural low permeability of the underlying clayey soils combine to produce conditions wherein most precipitation is converted to runoff. This condition resulted in the need to straighten and channelize the Rouge River to direct runoff away from development as quickly as possible and avoid the expensive consequences of flooding developed areas. Limited natural deposits of surficial sand and artificial deposits of course fill materials provide some temporary storage of precipitation but the thin, shallow nature of these deposits permits rapid evapotranspiration and as a result these deposits do not provide a reliable groundwater source. In developed areas, these deposits also tend to drain into both storm and sanitary sewers and along utility bedding materials in utility trenches that are excavated into the clay subsoils.

The Rouge River receives the regional runoff through direct overland flow and storm sewers. Several communities upstream from the Site including Dearborn Heights, Inkster, Redford Township, Livonia, and Farmington Hills drain untreated sanitary and stormwater into the Rouge River during storm events. Upstream communities also discharge treated and partially treated municipal wastewater into the Rouge River contributing to the condition of the receiving waters.

4.0 SITE SETTING

4.1 LOCAL TOPOGRAPHY

The local topography of the Site is presented on Figure 1.1. The ground surface at and around the Site is generally flat. Figure 1.1 indicates that ground surface elevations at the Site range from 580 to 590 feet AMSL.

4.2 LOCAL GEOLOGY

The subsurface geology at the Site is based on a review of boring logs generated from soil borings completed at the adjacent Rouge Manufacturing Complex in previous engineering and environmental investigations and test pit and borehole logs from investigations at the Site. These former investigations were conducted at the Oil Polishing Lagoons, Proposed Mill Scale Storage Area (Unused Area), Dearborn Engine Plant Area, the Blast Furnace Area, the Transportation Services Area, the North Yard/Locomotive Area, and the Injection Well Area. Collectively, they form a representative composite of the geology present at the Schaefer Road Area. However, the borings for the investigations generally provided information on the geologic (and hydrogeologic) conditions encountered within the uppermost 30 feet of unconsolidated material. Information on geologic conditions at depths greater then 30 feet was obtained from the boring logs associated with the deep waste injection well and a dry oil and gas well at the Rouge Manufacturing Complex. Both of these wells were extended through the entire column of unconsolidated deposits and at least 3,800 feet into the underlying bedrock. As discussed in Section 3.5.1, the glacial depositional environment across the county was generally consistent and resulted in thick, clay-rich lake bed deposits over the bedrock. The glacial-lacustrine deposits identified at depth in the former deep well areas should be representative of glacial deposits found at depth across the entire Site.

Based on the boring logs available, the geology across the Site can be grouped into three general units; a surficial geology fill unit, an underlying silty clay unit, and a bedrock unit. Each unit is described below.

The composition of the surficial geology fill material varied from a homogeneous black to brown fine- to medium-grained, well sorted sand (engineering backfill) to poorly sorted heterogeneous mixtures of slag, cinders, coke, crushed concrete, brick, metal fragments, sand, sand and gravel, and/or silty clay. The thickness of the fill material varied from a few feet to over 20 feet below grade. The greatest depths of fill material

(>20 feet)– were typically observed in locations that were altered by construction/excavation activities used in the Rouge River realignment and in plant design and supporting infrastructure (i.e., basements, foundations, utilities, USTs, etc.).

The silty clay unit is typically brown or gray (or a combination of the two), with minor amounts of sand and gravel. Its consistency varies from soft to hard with some fractures noted in the stiff clay. The silty clay unit is present across the entire Site and was found as shallow as 1 foot below grade and extends to depths as great as 113 feet below grade (near Greenfield and Rotunda).

The bedrock unit consists of a Devonian-aged carbonate-evaporite sequence. It's composed of shales, limestones, dolomites, gypsums, anhydrites, and halites.

4.3 LOCAL HYDROGEOLOGY

As described above, glacial overburden at the Site is mainly comprised of low permeability lake bed deposits that are poor sources of groundwater. The lacustrine deposits are predominately silt and clay materials, which exhibit very slow percolation rates and very low recharge rates. In boring logs from previous investigations, no significant water bearing horizons were observed in the clay-rich deposits. Several moist sandy clay or silty sand horizons were identified but were generally thin, isolated, laterally-discontinuous deposits that are underlain and overlain by low permeability clay deposits. These clay deposits act as a low permeability confining layer that retards vertical migration into the underlying unconsolidated and consolidated deposits at the Site.

When groundwater has been encountered at the Site, the water is generally trapped within permeable fill material perched upon the impermeable clay deposits. The depth to water is typically very shallow and varies with seasonal precipitation. Groundwater recharge and movement in these fill areas are often controlled by surface water runoff and permeable backfill material within utility corridors.

No bedrock water wells currently exist at the Site.

4.3.1 LOCAL GROUNDWATER USE

As described in Section 3.2, all potable water for the Site is supplied by the Detroit Water and Sewerage Department. Water from the system is used for industrial processes, industrial cooling, and human consumption.

4.4 LOCAL HYDROLOGY

The Rouge River forms the south and west boundary of the Site. As discussed in Section 3.7, this and other sections of the Rouge River were realigned and channelized by the Army Corp of Engineers in 1969 as part of a flood control program.

Other than the Schaefer Road surface impoundments there are no streams, surface water bodies, or creeks located within the Site's boundaries.

4.5 LOCAL SUMMARY

Site-specific conditions generally fit into the description of regional conditions. A large part of the Site is covered with impoundments that prevent infiltration. The unused portion of the Site has a vegetative cover that evapotranspirates shallow infiltration back to the atmosphere. Deep infiltration is prevented by the underlying clay soils. Water below the root zone may flow along the clay surface when a hydraulic gradient exists and discharge to the Rouge River through pressure relief vents built into the concrete channel.

Upstream discharges described in Section 3.8 affect Rouge River water quality at the Site.

5.0 REMEDIAL INVESTIGATION SCOPE OF WORK

The Scope of Work for the Remedial Investigation is comprised of characterizing the Schaefer Road Area and preparing a Remedial Investigation Report.

The purpose of sampling activities is to collect the data necessary to achieve the objectives defined in Section 1.2 under a continuing industrial land use scenario. Sampling activities will generally be completed as outlined below, although methods will be varied as necessary to accommodate the specific features at each location.

The sampling strategy for the Remedial Investigation is based on a review of the operations and processes utilized at the Site.

The strategy for the Remedial Investigation is also based on the current approaches being utilized by MDEQ-WMD related to response activities at industrial properties. The relevant factors which guide the appropriate application of the Act 451, Part 201 industrial standards are as follows:

1. the Site is zoned and utilized for industrial purposes;
2. appropriate security measures are currently in place to restrict Site access;
3. future land use plans contemplate the continued industrial use of the Site;
4. the Site is serviced by a municipal water supply;
5. there are no overburden water bearing zones at the Site; and
6. the bedrock water bearing zones, which are not locally used as water supplies off Site, are protected by significant overlying confining clay till aquitards.

Based upon the factors summarized above, the Act 451, Part 201 generic industrial direct contact criteria for both soil (IDC) and the perched water table zone groundwater (GCC) are applicable for use as screening levels for the Site. A more Site-specific (or area specific) risk based (i.e., limited industrial) approach may be utilized in the future to more accurately identify potential risks which may exist at the Site (as required).

The Act 451, Part 201 generic industrial criteria to be used for comparison of the data are summarized as follows:

Soil

1. Statewide Default Background Levels
2. Industrial Drinking Water Protection Criteria (IDWP)
3. Industrial Direct Contact Criteria (IDC)
4. Soil Volatilization to Indoor Air Inhalation Criteria
5. Infinite Source Soil Inhalation Criteria
6. Particulate Soil Inhalation Criteria

Water

1. Groundwater Contact Criteria (GCC)
2. Industrial Drinking Water Criteria (IDWC)
3. Industrial Groundwater Volatilization to Indoor Air Inhalation Criteria
4. Groundwater/Surface Water Interface Criteria (GSI)

Proposed Remedial Investigation sampling locations are presented on Figure 5.1. Exact sample locations will be determined based on the actual field conditions encountered. Surface soil, subsurface soil, background soil, and groundwater sampling (if possible) strategies are further discussed below.

A. Surface Soil Sampling

A surface soil sample will be collected at each of the borehole locations presented on Figure 5.1. These samples will be collected from the 0 to 0.5 feet below ground surface (bgs) interval. Sampling and analytical protocols are presented in the QAPP and FSP, respectively.

B. Subsurface Soil Sampling

Subsurface soil samples will be collected at selected borehole locations presented on Figure 5.1. The subsurface soil sample will be collected at the interval exhibiting the greatest degree of staining or positive response on the PID. If no staining or PID response is encountered, a subsurface sample may not be collected. All boreholes will be installed to a depth of approximately 5 to 10 feet into the native clay till horizon (as directed by the CRA field representative). Sampling and analytical protocols are presented in the QAPP and FSP, respectively.

C. Background Soil Sampling

To allow evaluation of the soil sample results from the Site and to obtain Site-wide stratigraphic information, background soil sample collection from native soils will be attempted. A total of four to eight samples will be collected from areas at the Site or adjacent to the Site with no history of activities that may have impacted the soil. The location of these samples will be determined in the field. The distance between the sample locations will be maximized in order to obtain a representative background data set. The four background soil boreholes will be drilled to a total depth of approximately 20 feet. Background soil samples will be analyzed for grain size, vertical hydraulic conductivity, and TAL inorganics. Sampling and analytical protocols are presented in the QAPP and FSP, respectively.

Part 201 default values for background soil conditions may be used if acquisition of natural background soils proves impractical.

D. Groundwater Sampling

The locations of the proposed temporary monitoring well is presented on Figure 5.1 and summarized in Table 5.1. It has not been determined whether or not groundwater is present in a generally continuous system with recharge and discharge zones or if groundwater is present in discontinuous pockets. If there is a continuous groundwater flow system, the hydraulic gradient and consequently the direction of the flow may be affected by the current and former Rouge River channels and by underground utilities. Consequently, there is no preconceived definition of upgradient and downgradient.

The temporary monitoring well will be installed to determine if perched groundwater exists in the near surface (upper 5 to 10 feet) at the Site. Additional temporary monitoring wells, if any, will be installed if the presence of a significant groundwater aquifer is identified. The scope of the groundwater investigation may be refined based upon the MDEQ-WMD guidance titled "Groundwater Not In An Aquifer" and an assessment of the presence of affected soil based upon the soil analytical results developed during the surface and subsurface soil monitoring. Sampling and analytical protocols are presented in the QAPP and FSP, respectively.

If free product is encountered during the Remedial Investigation in sufficient quantity, a sample will be collected for characterization. The free product sample will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, specific gravity, and viscosity.

5.1 CHARACTERIZATION

The following subsections outline the proposed investigation at each subunit of the Site and provide descriptions of the current conditions of each subunit. Figures 1.2 and 5.1 present the locations of these areas. The locations of the proposed boreholes are presented on Figure 5.1 and summarized in Table 5.1.

5.1.1 EAST AND WEST SLUDGE PONDS

The East and West Sludge Ponds area is located at the south end of the Site. The area that may potentially have been affected by waste sludge or oil during handling and operation activities will be investigated. The location of the East and West Sludge Ponds is presented on Figure 5.1.

5.1.1.1 PROPOSED SOIL INVESTIGATION

The purpose of the proposed soil investigation is to collect the data necessary to achieve the objectives defined in Section 1.2 for the East and West Sludge Ponds under a continuing industrial land use scenario.

Approximately four surface soil samples will be collected from the 0- to 0.5-foot interval at sludge handling locations and adjacent to the oil storage tank (see Figure 5.1). Surface sampling locations that have exceedances of the screening criteria will be further evaluated by advancing and sampling from a borehole. A minimum of one borehole location in the East and West Sludge Ponds area will be selected for soil sampling (see Figure 5.1). The borehole will be sampled continuously to a depth of approximately 5 feet into the native clay till soils. Surface and subsurface samples will be collected in separate field mobilizations.

The subsurface soil sample exhibiting the most staining or highest PID response will be submitted for chemical analysis as discussed in Section 5.0. If no staining or PID response is encountered, a subsurface sample may not be collected.

The soil samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

5.1.1.2 PROPOSED GROUNDWATER INVESTIGATION

If the subsurface investigation reveals the presence of a perched groundwater unit then a temporary monitoring well will be installed, developed, and sampled.

The perched water samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

The temporary groundwater monitoring wells will be scheduled for abandonment 3 months after installation unless groundwater sample results indicate the presence of constituents above screening values.

5.1.2 OIL HOUSE

The Oil House contains two ASTs which receive waste oil from the oil skimmers at the Site. The location of the Oil house is presented on Figure 5.1. A survey will be conducted prior to the soil investigation activities to develop a more detailed plan of the Oil House.

5.1.2.1 PROPOSED SOIL INVESTIGATION

The purpose of the proposed soil investigation is to collect the data necessary to achieve the objectives defined in Section 1.2 for the Oil House area under a continuing industrial land use scenario.

Two borehole locations in the Oil House area will be selected for soil sampling (see Figure 5.1). The borehole will be sampled continuously to a depth of approximately 5 feet into the native clay till soils.

At each borehole location, one sample of the surface soil will be collected at the 0- to 0.5-foot bgs interval as discussed in Section 5.0. The subsurface soil sample exhibiting the most staining or highest PID response will also be submitted for chemical analysis as discussed in Section 5.0. If no staining or PID response is encountered, a subsurface sample may not be collected.

The soil samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

5.1.2.2 PROPOSED GROUNDWATER INVESTIGATION

If the subsurface investigation reveals the presence of a perched groundwater unit then a temporary monitoring well will be installed, developed, and sampled.

The perched water samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

The temporary groundwater monitoring wells will be scheduled for abandonment 3 months after installation unless groundwater sample results indicate the presence of constituents above screening values.

5.1.3 OIL POLISHING LAGOONS

The Oil Polishing Lagoons receive treated wastewater from the two on-Site oil skimming clarifiers and remove any residual oil or solids present in the wastewater. The Melvindale Dump was reportedly located south of the Primary Oil Polishing Lagoon. The location of the Oil Polishing Lagoons is presented on Figure 5.1.

5.1.3.1 PROPOSED SOIL INVESTIGATION

The purpose of the proposed soil investigation is to collect the data necessary to achieve the objectives defined in Section 1.2 for the Oil Polishing Lagoons under a continuing industrial land use scenario.

Eight borehole locations in the Oil Polishing Lagoons area will be selected for soil sampling (see Figure 5.1). The borehole will be sampled continuously to a depth of approximately 5 feet into the native clay till soils.

At each borehole location, one sample of the surface soil will be collected at the 0- to 0.5-foot bgs interval as discussed in Section 5.0. The subsurface soil sample exhibiting the most staining or highest PID response will also be submitted for chemical analysis as

discussed in Section 5.0. If no staining or PID response is encountered, a subsurface sample may not be collected.

The soil samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

5.1.3.2 PROPOSED GROUNDWATER INVESTIGATION

If the subsurface investigation boreholes reveal the presence of a perched groundwater unit then a temporary monitoring well will be installed, developed, and sampled. A minimum of one temporary monitoring well will be installed, as shown on Figure 5.1, to evaluate the potential presence of perched groundwater.

The perched water samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

Temporary groundwater monitoring wells will be scheduled for abandonment 3 months after installation unless groundwater sample results indicate the presence of constituents above screening values.

5.1.4 UNUSED AREA

The Unused Area was reported to have been filled with a variety of materials. The location of the Unused Area is presented on Figure 5.1. Prior to 1968, the southernmost tip of the Unused Area, south of the former river channel, was owned by MichCon (as indicated on Figure 2.3), and all other portions of the Unused Area have been owned by Ford.

5.1.4.1 PROPOSED SOIL INVESTIGATION

The purpose of the proposed soil investigation is to collect the data necessary to achieve the objectives defined in Section 1.2 for the Unused Area under a continuing industrial land use scenario.

Fourteen borehole locations in the Unused Area will be selected for soil sampling (see Figure 5.1) to investigate potential fill materials and historic features. The boreholes will

be advanced to a depth of approximately 5 feet into the native clay till soils. The actual location and number of boreholes advanced may be revised based on Site conditions encountered during the investigation.

At each borehole location, one sample of the surface soil will be collected at the 0- to 0.5-foot bgs interval as discussed in Section 5.0. The subsurface soil sample exhibiting the most staining or highest PID response will also be submitted for chemical analysis as discussed in Section 5.0. If no staining or PID response is encountered, a subsurface sample may not be collected.

The soil samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

5.1.4.2 PROPOSED GROUNDWATER INVESTIGATION

If the subsurface investigation reveals the presence of a perched groundwater unit then a temporary monitoring well will be installed, developed, and sampled.

The perched water samples (and associated QA/QC samples) will be analyzed for TCL VOCs, TCL SVOCs, TCL PCBs, and TAL inorganics.

The temporary groundwater monitoring wells will be scheduled for abandonment 3 months after installation unless groundwater sample results indicate the presence of parameters above screening values.

6.0 DATA EVALUATION

6.1 OBJECTIVES

The data evaluation process will determine if the investigation data are sufficient in quality and quantity to achieve the objectives defined in Section 1.2.

The data analysis will be conducted on each data point that is generated during the Remedial Investigation.

6.2 DATA VALIDATION AND ANALYSIS

The data will be validated as discussed in the QAPP (Appendix C) to ensure that the data are useable. The data will be received in electronic form from the laboratory, where possible, and a database will be developed to facilitate data review and calculations.

Cross-checking between various data sets will be performed to ensure that the data are consistent and correct. This may include comparison between Remedial Investigation sample results from the same area, comparison between Remedial Investigation sample results for the entire Site, and concurrent evaluation of chemical and physical data.

6.3 EXPOSURE ASSESSMENT

The chemical data will be evaluated to identify the nature and extent of affected media, if any, associated with each subunit. The Remedial Investigation data for each subunit will be compared to screening levels to determine the necessity for the completion of area-specific evaluations.

A Risk Assessment may be conducted if the Site conditions do not meet the Part 201 screening levels presented in Section 5.0. If conducted, the Risk Assessment will be completed in a manner consistent with applicable guidance, including Risk Assessment Guidance for Superfund (RAGS).

6.4 POST-INVESTIGATION DATA EVALUATION

A post-investigation evaluation of the data will be conducted to:

- characterize the nature and extent of hazardous substances, if any, associated with the Site;
- assess the potential risk to public heath, safety, or welfare, or to the environment associated with any potential release of hazardous substances considering the exposure assessment discussed in Section 6.3;
- evaluate the need for response activities, if any, for the Site;
- if response activities are required, determine whether sufficient data are available to evaluate and support selection of remedial action technologies; and
- identify additional data collection activities, if any, required to support the response activities evaluation.

The data evaluation will be presented in the Remedial Investigation Report.

6.5 POTENTIAL REMEDIAL ACTION TECHNOLOGIES

The following sections present potential remedial action technologies that could be considered for the Site, as necessary, to protect public health, safety, or welfare, or the environment. The list is not intended to be limiting. Additional potential response activities could be added and technologies can be combined. A final list of remedial action technologies will be presented and evaluated in the Remedial Action Plan, and will utilize the results of the Remedial Investigation.

The potential corrective action technologies may also be used for interim response activities that do not allow exposure that will result in a risk to public health.

6.5.1 NO ACTION

The "No Action" alternative allows the Site to exist as it is without the implementation of any remedial actions. The "No Action" alternative may incorporate long-term environmental monitoring at the Site.

6.5.2 LIMITED ACTION

The "Limited Action" alternative involves the implementation of institutional controls and property access restrictions to reduce potential human and/or environmental exposure to hazardous substances. Limited action may also include natural attenuation or other passive technologies.

Institutional controls would involve the placement of a restriction within the deed (or other institutional controls such as zoning or building code changes) to the property preventing the property owner from conducting certain activities that may lead to unacceptable exposures (e.g., excavation, residential use). This action would also warn prospective future purchasers of the past history and condition of the property.

Property access restrictions may include upgrading the existing security fence, constructing additional security fencing, or instituting other controls to minimize access to the Site by unauthorized personnel.

6.5.3 CONTAINMENT

The "Containment" alternative involves the use of structural controls to contain or otherwise restrict the mobility and migration of hazardous substances. Potential containment technologies applicable to the Site include one or a combination of the following:

- capping; and
- property re-development.

Capping would involve the construction of a low permeability cover over the impacted soil at the Site. The purpose of the cover would be to prevent direct contact and reduce infiltration of precipitation through the soil and subsequent percolation of potentially affected water into the subsurface. In addition, capping would provide long-term protection against erosion and subsequent transport of hazardous substances.

Hazardous substances would remain under the "Containment" alternative. However, the potential for unacceptable future human exposure would be significantly reduced or eliminated. The "Containment" alternative could also involve consolidation of hazardous substances in a centralized location where they can be effectively managed.

6.5.4 TREATMENT

The "Treatment" alternative would involve the use of treatment technologies to immobilize, remove, or destroy hazardous substances from environmental media. Numerous treatment technologies are available, which may use physical, chemical, or biological treatment methods and may be combined with natural attenuation. Either in situ or ex situ treatment technologies could be employed. Ex situ treatment technologies could be employed both on or off the Site. The treatment technologies to be evaluated would be selected depending on the chemical(s) to be removed or destroyed, the environmental media to be treated, and various physical characteristics of the media.

Hazardous substances would be immobilized, removed, or destroyed under the "Treatment" alternative, and therefore, the potential for unacceptable future human or environmental exposure would be eliminated. The "Treatment" alternative may also involve consolidation of affected materials in a centralized location where they can be effectively treated and managed.

6.5.5 REMOVAL

The "Removal" alternative involves the removal of affected media from the Site for permanent disposal.

Hazardous substances would be removed, and therefore, the potential for unacceptable future human or environmental exposure at the Site would be eliminated.

7.0 REMEDIAL INVESTIGATION REPORTING

The Remedial Investigation Report will be developed after investigative activities have been completed to present all data that have been gathered as part of the investigation, an analysis of the data, and conclusions about the status of the Site and the need for remedial action. The Remedial Investigation Report will include the following information:

- a description of the various field activities performed during the course of the investigation;
- a description of the physical characteristics of the Site, including topography, hydrology, hydrogeology, and geology;
- an identification of potential exposure pathways;
- a description of the nature and extent of hazardous substances, if any, associated with the Site and the impact, including potential future risk, if any, to public health, safety, or welfare, or to the environment at the Site;
- a discussion of potential routes of migration for the hazardous substances, if any, associated with the Site and factors expected to affect migration;
- an identification of areas where interim response activities are required to address current conditions under continued industrial land use;
- an identification of areas where remedial action is required to address any potential unacceptable future condition under continued industrial land use; and
- additional relevant information, including but not limited to field forms, analytical data, and risk assessment methods.

The data analysis and conclusions presented in the Remedial Investigation Report will form the basis for the Remedial Action Plan. Any data deficiencies identified in the Remedial Investigation that are necessary to complete these reports will be identified and filled by the collection of additional data.

8.0 REMEDIAL INVESTIGATION SCHEDULE

The Remedial Investigation Work Plan will be implemented in a manner consistent with the schedule presented on Figure 8.1.

A calendar based schedule is presented that anticipates a final approved work plan by the end of April 2001. The entire schedule will be moved into the future if the Work Plan is approved after May 1, 2001. A short delay after May 1, 2001 will not affect the schedule significantly. Lengthy delays that push field work past an October 1, 2001 start will push field work into the part of the year where weather conditions could further delay progress and field work could be held over into Spring 2002.

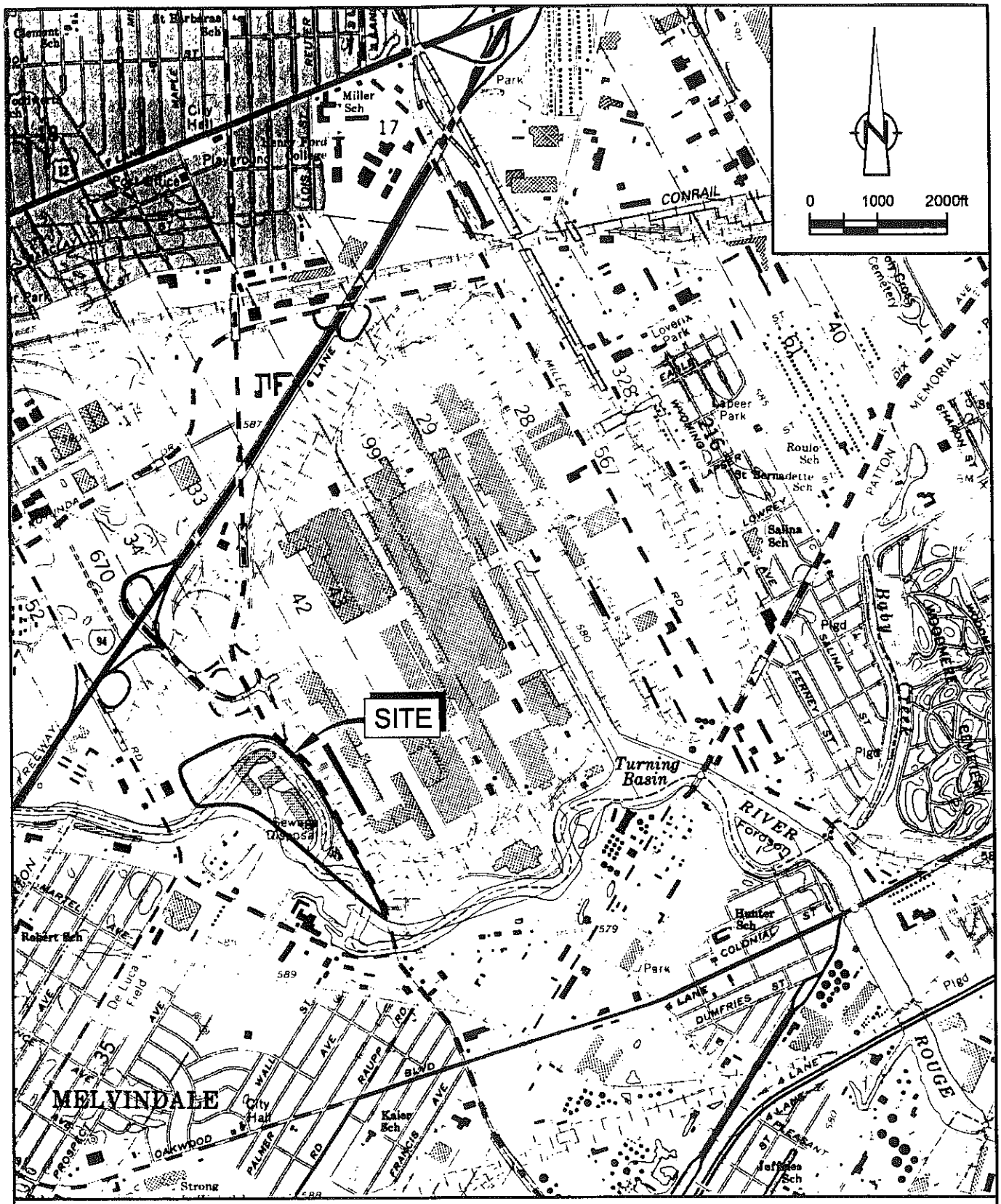
The schedule could also be affected by access issues resulting from maintenance or other work that may be required to keep the Schaefer Road Wastewater Treatment Plan fully operational and other regulatory approvals that may become necessary.

The schedule will be revised if a change becomes apparent.

9.0 REFERENCES

1. "Current Conditions Report - Rouge Manufacturing Complex", CRA, November 2000.
2. "Interim Final RCRA Site Investigation (RFI) Guidance", EPA 530/SW-89-031; Waste Management Division, Office of Solid Waste, USEPA; May 1989.
3. Michigan Public Act 451, Part 201, Environmental Remediation.

FIGURES

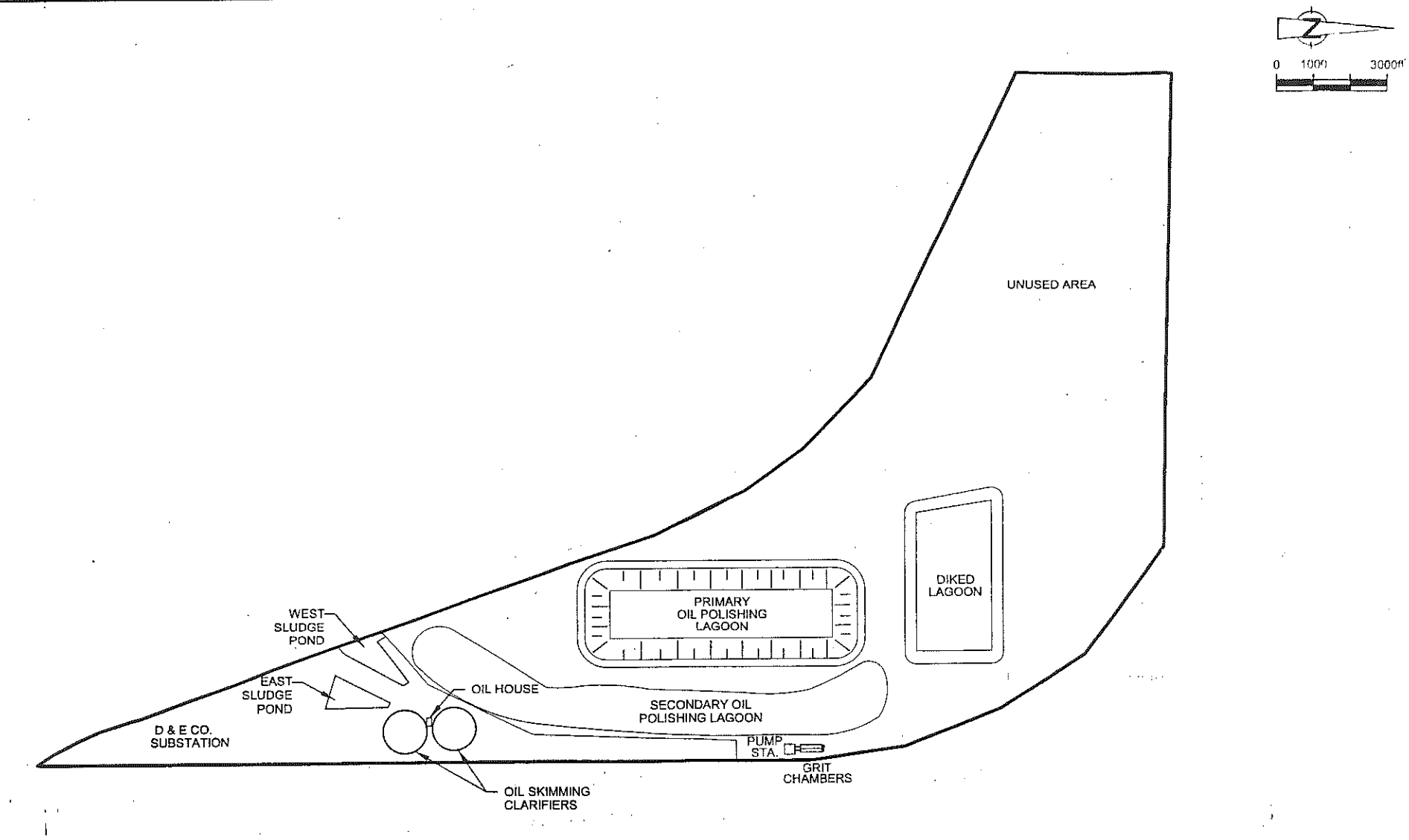


SOURCE: USGS QUADRANGLE MAP;
DEARBORN, MICHIGAN

figure 1.1

SITE LOCATION MAP
SCHAEFER ROAD AREA
Dearborn, Michigan

16636-00(001)GN-WA002 JAN 29/2001



LEGEND

LIMIT OF SCHAEFER ROAD AREA

figure 1.2

SITE PLAN
SCHAEFER ROAD AREA
Dearborn, Michigan